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**AN/AAS-18 IR SET MODIFICATION
TO DUAL SPECTRUM CAPABILITY**

A. Meyer

[Handwritten signature]

Technology Incorporated

TECHNICAL REPORT AFAL-TR-70-154

September, 1970

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Air Force Avionics Laboratory
and
Aerospace Medical Research Laboratory
Air Force Systems Command
Wright-Patterson Air Force Base, Ohio

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**AN/AAS-18 IR SET MODIFICATION
TO DUAL SPECTRUM CAPABILITY**

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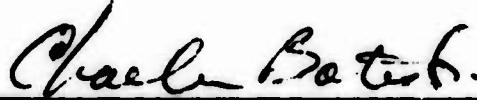
FOREWORD

This Final Report was prepared by Technology Incorporated, 7400 Colonel Glenn Highway, Dayton, Ohio under the provisions of Contract Number F33615-69-C-1902, Project Number 9-13187 AVRS-665A. It summarizes the efforts and findings that have been accomplished during the span of the contract on the modification and testing of the AN/AAS-18 Infrared Detector Set into a Dual-Spectrum Detection System. This effort was sponsored by the 6570th Aerospace Medical Research Laboratory, Wright-Patterson Air Force Base, Ohio 45433. Technical assistance was provided by 1st. Lt. James Brindle, USAF of the 6570th Aerospace Medical Research Laboratory, MRHR, Mr. Robert Berry, of the Air Force Avionics Laboratory, AVRE, and Maj. C. F. Lam of the Air Force Avionics Laboratory, AVRS-665A. This report was submitted by the author, September 1970.

This technical report has been reviewed and is approved.



THOMAS R. NASON
Chief, 665A Program Office
Reconnaissance Applications Branch



CHARLES BATES, Jr.
Chief, Performance Requirements
Branch
Human Engineering Division

ABSTRACT

A system to obtain dual synchronous film records of a target in two different spectrums of the infrared region was required. An AN/AAS-18 Infrared Detecting Set Receiver was modified to contain two different detectors, one of Indium Antimonide, InSb, the other of Mercury-Doped Germanium, GeHg, plus additional circuitry to provide a video output from each detector. Two AN/AAS-18 Recorders and Power Supplies were interfaced together and operated from a common Control Panel to record on film the video information. An amplifier and controls were added to premit the selection of video output from either or both detectors for use with the Air Borne Infrared Raster Display system (ABIRD). As modified, the Dual-Spectrum Detection System allows film records of a target to be obtained in the 3 to 5 micron and the 8 to 13 micron regions. The two channels may be monitored simultaneously or independently on the ABIRD real-time display system.

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SECTION I

INTRODUCTION

The purpose of this program was to modify an existing AN/AAS-18 Infrared Detecting Set to provide a capability for broader coverage of the infrared spectrum. The original equipment configuration operated in a limited portion of the infrared spectrum but over a broad range of Velocity to Height ratios (V/H). The usage of the equipment in the Tactical Near-Real-Time Reconnaissance test aircraft does not require a broad V/H ratio capability but does require a broad IR spectrum coverage. To meet this requirement, the Air Force Avionics Laboratory acquired a modified AAS-18 Cooler-Detector unit and a complete second detection system. The effort described herein covers the requirement for installation of the new cooler-detector assembly, the design and fabrication of needed circuitry and interfacing to operate two complete recorders as a unified system.

The dual-spectrum system includes the complete original operating system, the modified cooler-detector assembly, the recorder, film magazine, and power supply of a second detecting set, necessary interface circuitry and an auxiliary control panel. The revised system utilizes one detector of Indium Antimonide, (InSb), and one detector of Mercury-Doped Germanium, (GeHg), of equal aperture size, to give separate and simultaneous coverage with the infrared spectrum in the 3 to 5 and the .8 to 13 micron regions respectively.

The objectives of the new dual spectrum system were: (a) to obtain separate airborne film records of the two different detectors: (b) to monitor any combination of the system video outputs

on the Airborne Infrared Raster Display (ABIRD) monitor system, and (c) provide the ability to record the output of either or both detectors on-board the test aircraft by using magnetic tape which can be played back and analyzed later on the ground.

Several references are made in this report to the ABIRD system. Information on this system may be obtained from a technical report titled: AIRBORNE INFRARED RASTER DISPLAY (ABIRD) Real Time Viewer, Final Technical Report number C4-818300-18 dated 15 April 1968,

SECTION II

THE ORIGINAL SYSTEM

Initially, the AN/AAS-18 Infrared Detecting Set was designed for use on the RF-4C aircraft. It consists of a receiver, a recorder, a film magazine, and a power supply. Control and monitoring were furnished to the system from several panels within the cockpit area and other aircraft systems. This system was selected to be used on the Tactical Near-Real-Time Reconnaissance test aircraft, a C-121, as its IR sensor. For this installation a special control panel was designed and fabricated to control and monitor the system in lieu of all the controls originally used in the RF-4C aircraft. A special gyro assembly was also fabricated to supply pitch and roll parameters, and an APN-153 doppler radar was modified to supply drift information as needed by the recorder, and installed in the C-121. This system utilized detectors covering the 8 to 13 micron IR region over a broad range of velocity to height ratios. The AN/AAS-18 system has two detectors of the same material, GeHg, each with different apertures, as well as its own preamplifier. The output of one or the other preamplifier was selected by a video selector switch, controlled by the system's V/H input, amplifier in the receiver's post amplifier, and routed to the system recorder. The video output was also routed to the ABIRD system for a realtime display. The original system configuration is shown in Figure 2 - 1 as it was installed in the C-121 test aircraft.

Figure 2 - 2 is a wiring schematic of the AN/AAS-18 Infrared Sensor Control Panel. No changes were made to this panel during

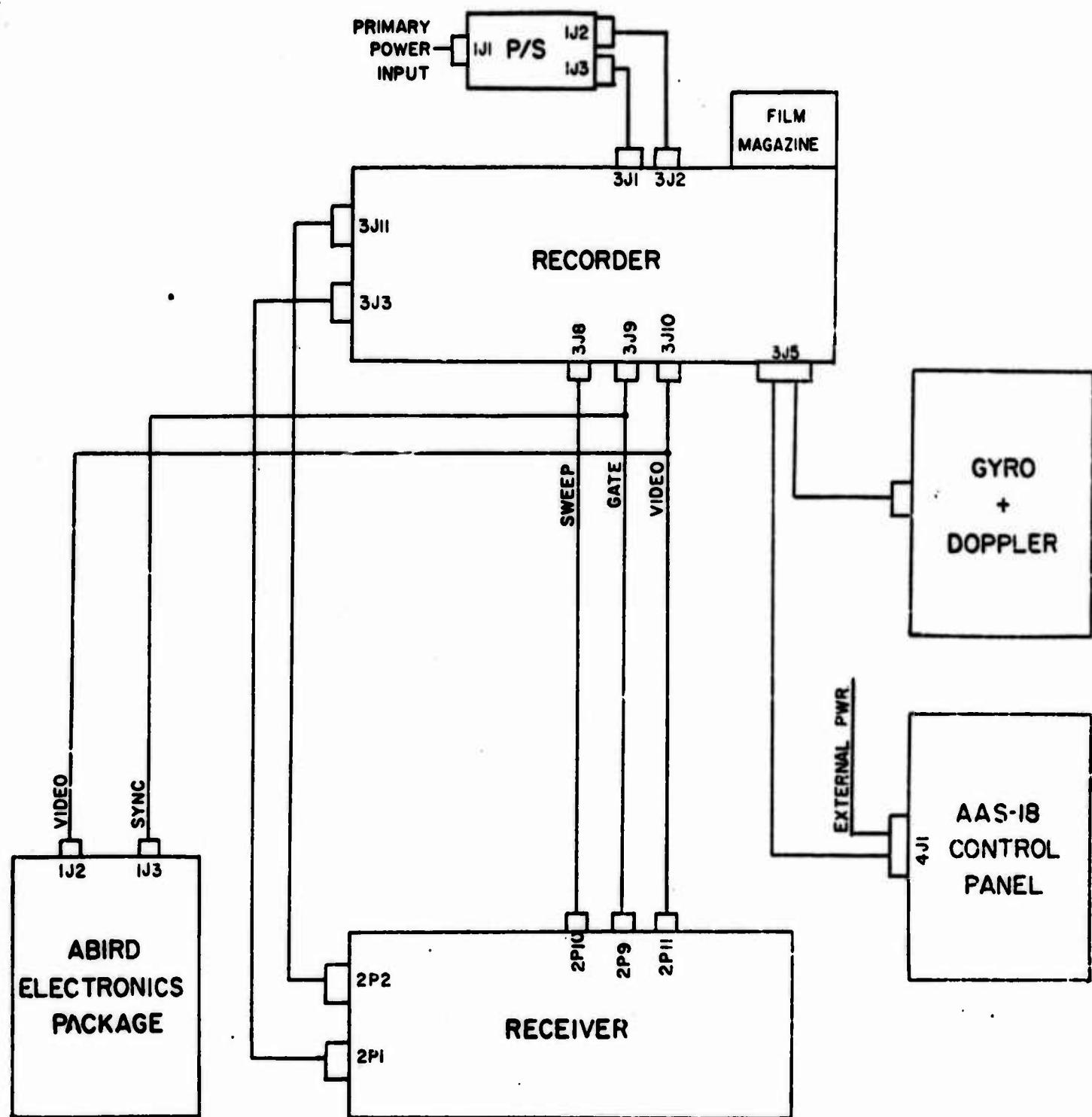


FIGURE 2-1
AN/AAS-18 IR DETECTOR SET
ORIGINAL CABLING CONFIGURATION

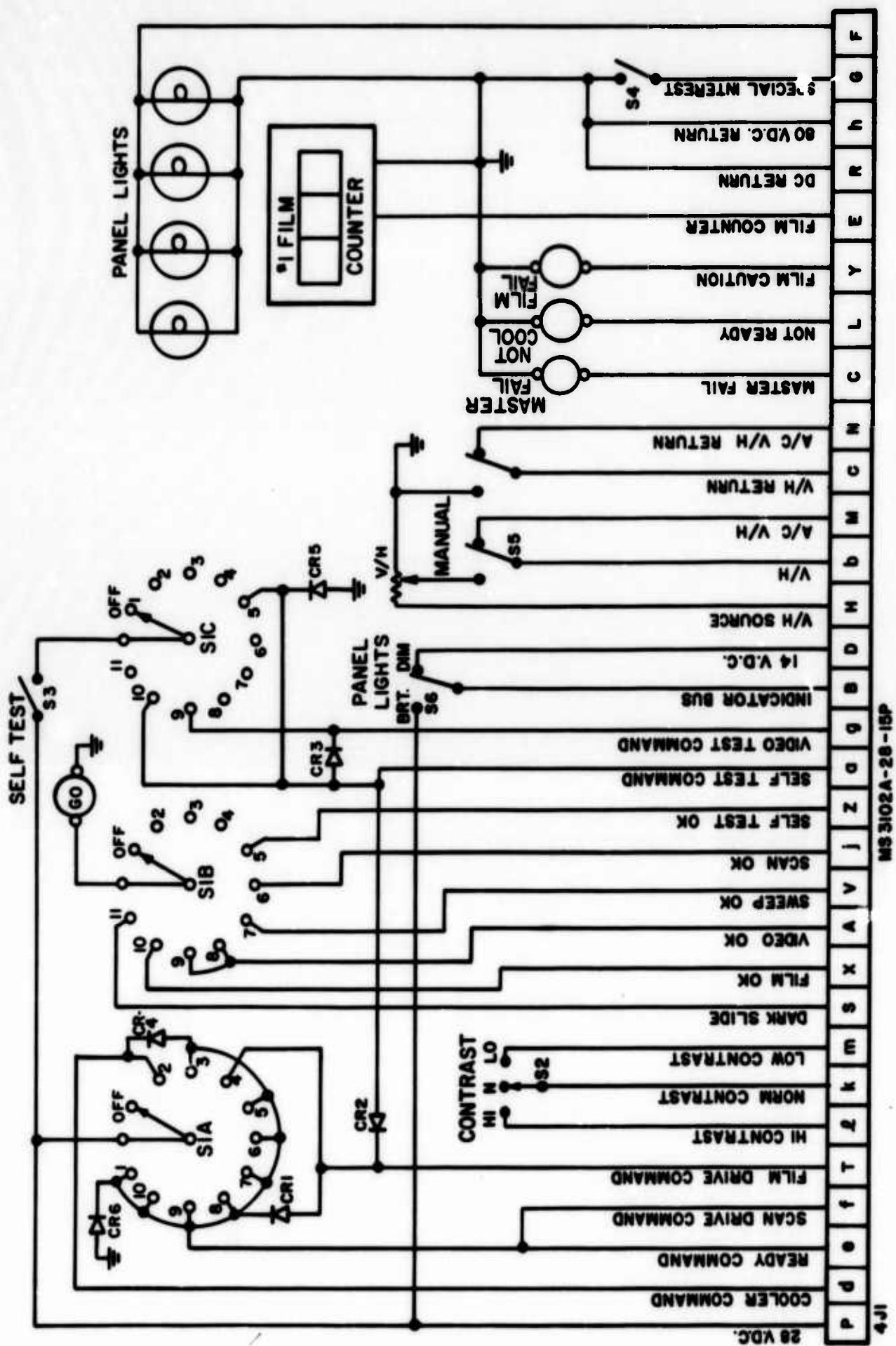


FIGURE 2-2. AN/AAS-18 INFRARED SENSOR CONTROL PANEL SCHEMATIC

the modification program, although it now controls and monitors two recording systems as outlined in Section III of this report.

A schematic of the Vertical Gyro assembly is presented in Figure 2-3. Again, this assembly is used in an identical manner as previously, although it now supplies attitude parameters to two recorders instead of one. The output synchro transmitters of the Vertical Gyro assembly already had the capability of operating two synchro control transformers in parallel with no alteration.

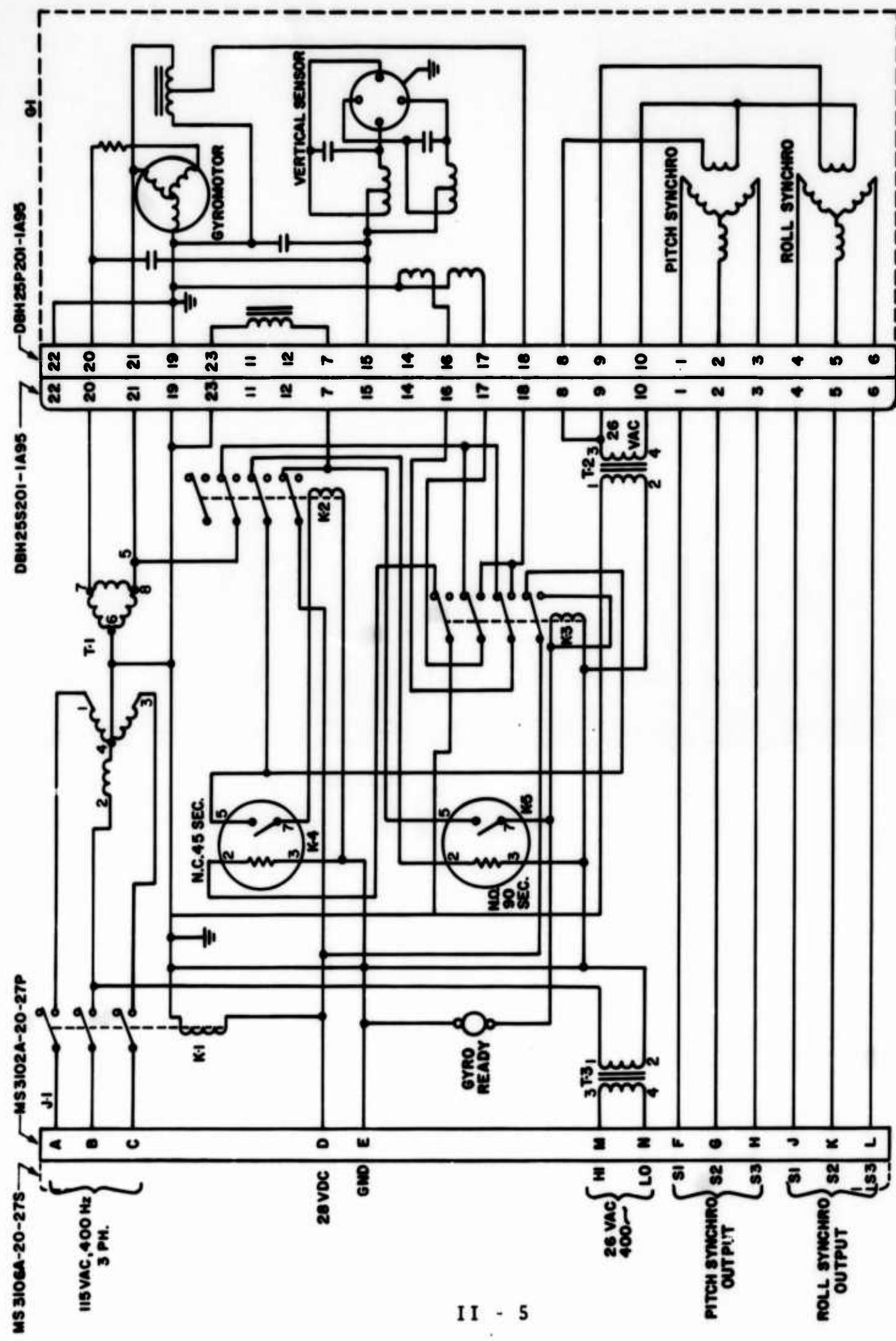


FIGURE 2-3. VERTICAL GYRO ASSEMBLY SCHEMATIC

SECTION III

THE DUAL SPECTRUM SYSTEM

The modified dual spectrum system consists of the original system's components plus an additional recorder, film magazine, and power supply. A dual interface box and an auxiliary control panel have been added to control and monitor the new dual sensor system using the existing control panel. The original cooler-detector assembly was replaced by an identical unit except that one of the mercury doped germanium detectors was replaced by an indium antimonide detector. An additional post-amplifier and support circuitry have been added to the receiver to accommodate the second detector.

System cabling has been changed to allow operation of both recorders from the single control panel. Shown in Figure 3-1 is a cabling diagram of the dual-spectrum system. The original system's cabling is used in addition to several new cables. Connectors were selected to allow disconnecting the control panel cable from receptacle 3J5 on the #1 recorder and connecting directly to the dual interface box receptacle 5J18, without a cable change. A new cable was added between the dual interface box, receptacle 5J19, and the 3J5 receptacle on recorder #1. The receiver is still controlled and powered by the #1 recorder system.

The control and monitor functions of the control panel are routed through the dual interface box where relays determine either dual or single system operation. The relays are in turn controlled by controls on the auxiliary control panel.

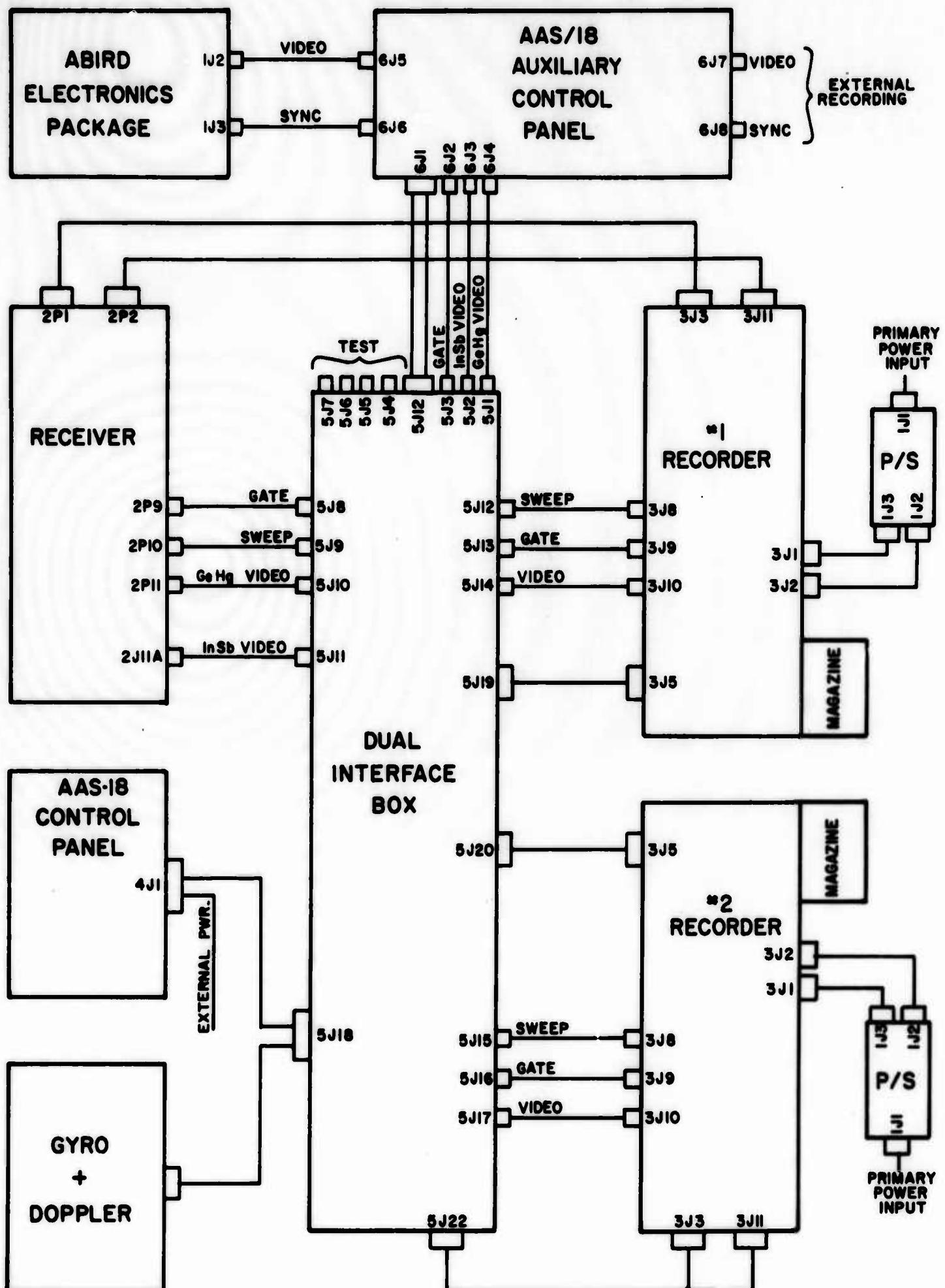


FIGURE 3-1. DUAL SYSTEM CABLING

The video, sweep, and gate signals from the receiver are routed to the dual interface box where multiple receptacles are provided for distribution of these signals to the recorders, the auxiliary control panel, and for external system testing or magnetic tape recording. The video signals that are routed to the auxiliary control panel are selected and mixed for presentation to the ABIRD system and to receptacles that may be used for external monitoring or recording.

Power for the second recorder is obtained from its own power supply unit which is connected to external aircraft power in the same manner as the original system. However, as a receiver is not being operated by the #2 recorder, circuitry has been incorporated into the dual interface box to duplicate the power load where necessary to maintain proper operation of the various power regulators in the #2 power supply package.

Figure 3-2 shows a block diagram of the video and sync signal routing in the dual spectrum system.

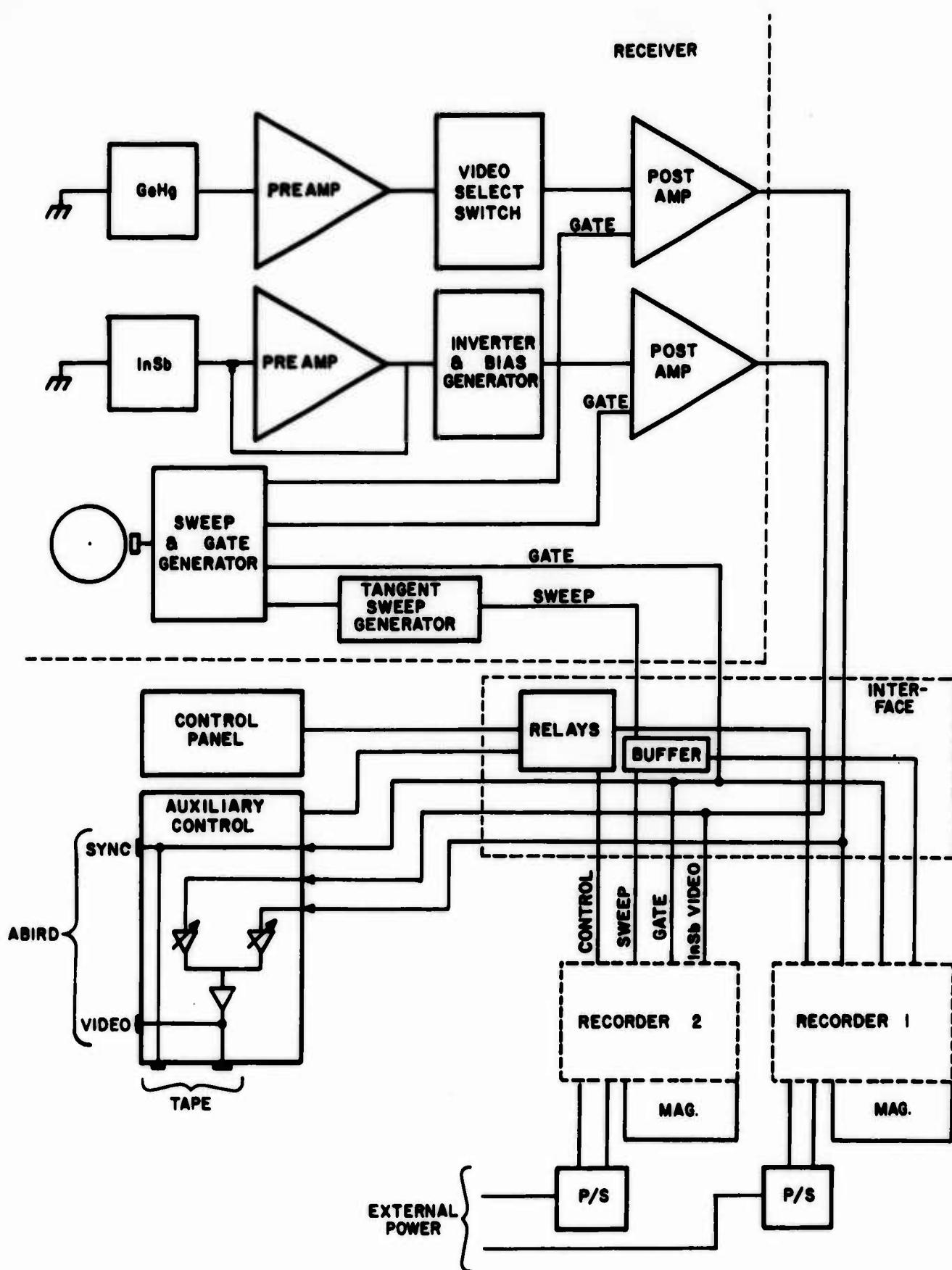


FIGURE 3-2. DUAL SPECTRUM VIDEO & SYNC
SIGNAL BLOCK DIAGRAM

SECTION IV

RECEIVER MODIFICATIONS

Basically, the changes to the receiver included replacing the original cooler/detector assembly with a modified similar unit, adding a signal inverter, a second post-amplifier and wiring changes to incorporate the additional units into the existing receiver circuitry.

The cooler/detector assembly, a removable unit of the receiver, was modified by Texas Instruments Inc., Dallas, Texas, prior to the beginning of this modification program. This modified unit had the larger of the two mercury-doped germanium detectors removed and an indium antimonide detector reinstalled with an aperture approximately equal to the remaining mercury-doped germanium detector.

The original detector/cooler assembly was removed from the receiver and the newly modified unit reinstalled and focused to the scanner optics. No changes in connections were needed as this unit retained the original receptacles and connectors. Also no changes in cooler plumbing were required.

The receiver wiring originally routed the two detector outputs through preamplifiers 2A7 and 2A8, a respectively common video selector switch, 2A9, to a single post amplifier, 2A3. Refer to Figure 4-1 for a block diagram of original video signal routing. The output of the 2A3 post amplifier was either one or the other detector as had been selected by the video selector switch 2A9 and the system V/H signal.

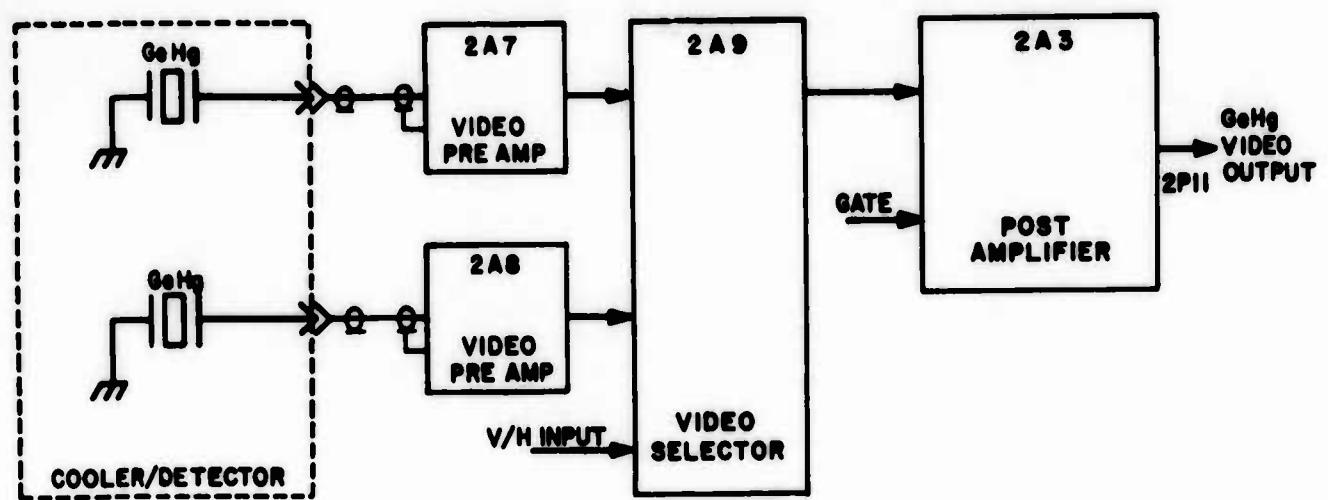


FIGURE 4-1 ORIGINAL RECEIVER VIDEO BLOCK DIAGRAM

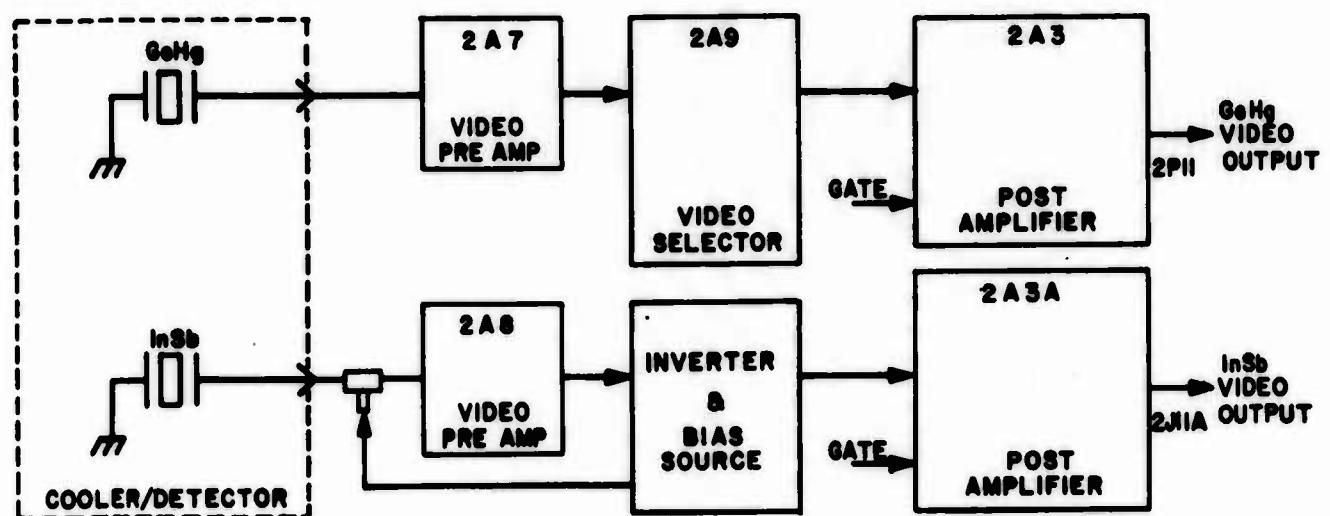


FIGURE 4-2. BLOCK DIAGRAM OF DUAL VIDEO CHANNELS

To obtain dual channel capability, the output of preamplifier 2A8 was disconnected from the video selector switch and rerouted through new circuitry to an added post amplifier for the new channel. See Figure 4-2 for a block diagram of the dual system.

The detectors, photoconductive semiconductor devices, require a constant bias to function. The mercury doped germanium requires a positive bias and the indium antimonide requires a negative bias. When infrared radiation illuminates these detectors, this bias causes an increase in the current through the detectors. These current variations are then routed to the respective video preamplifiers as video information.

The positive bias for the original GeHg detectors was generated in the detector's respective preamplifier and was adjusted by potentiometer R-18 as necessary. Refer to 4-3 for a schematic of the preamplifier. The positive bias required by the GeHg detector of the modified system is still obtained from its preamplifier. The negative bias required by the InSb detector had to be obtained from other sources as the preamplifier is a sealed module and no changes could be incorporated into it. This preamplifier is still used with the condition that the positive bias potentiometer R18 is adjusted fully counter-clockwise to ground. This terminates any positive bias from being generated. The needed negative bias is generated in the InSb inverter module and is connected between the InSb detector and the preamplifier 2A8 input with the use of a miniature tee adapter. Refer to Figure 4-4 for a wiring diagram of the inverter and bias source.

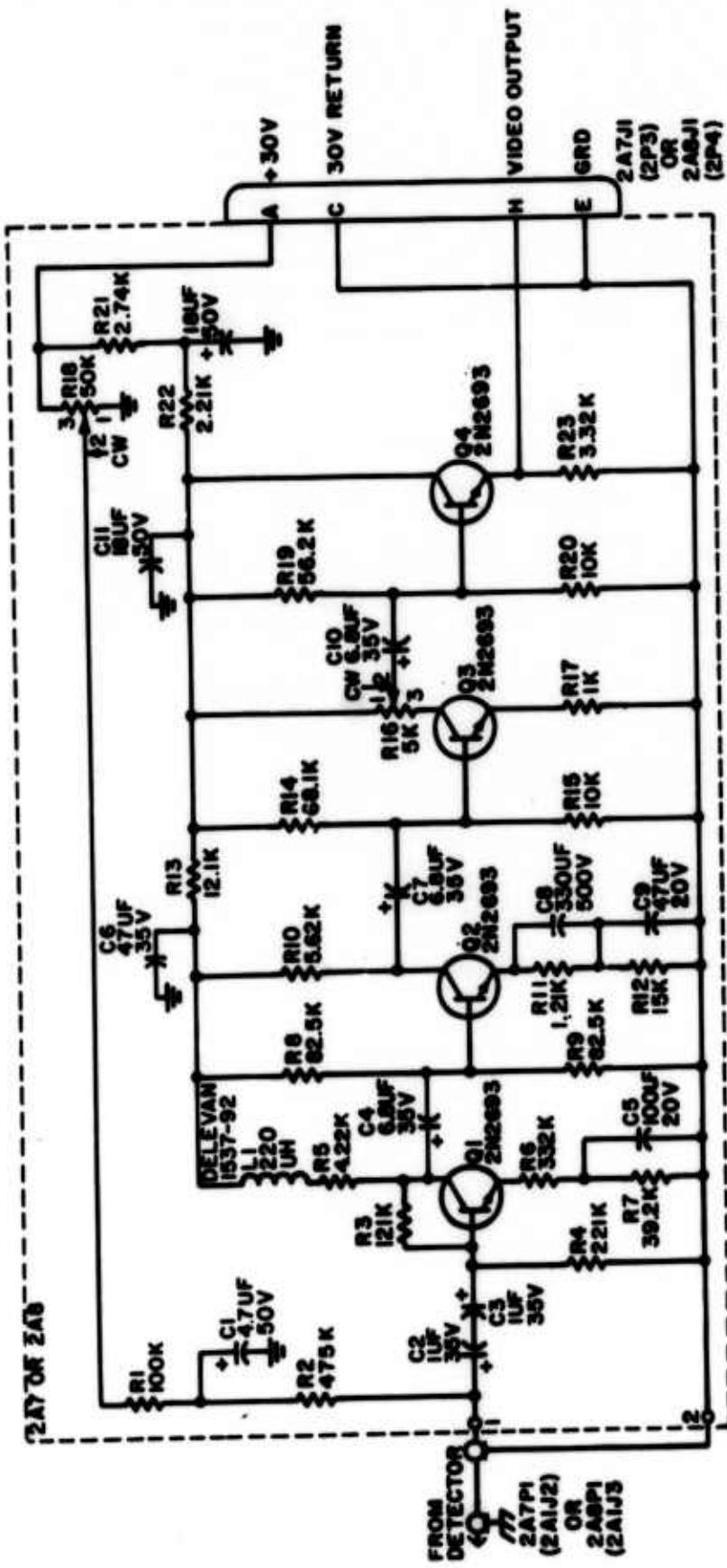


FIGURE 4-3. PREAMPLIFIER SCHEMATIC

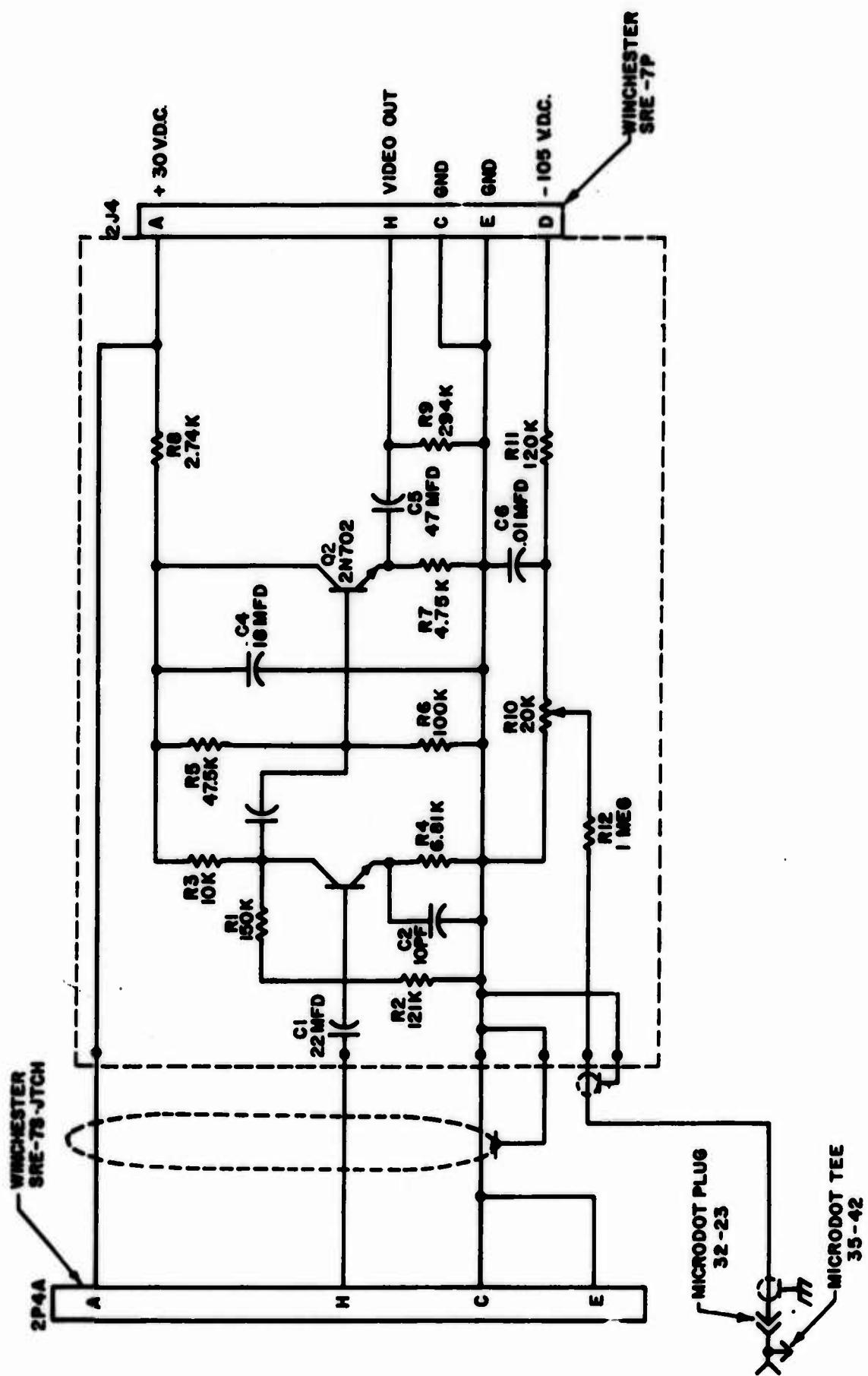


FIGURE 4-4. InSb INVERTER & BIAS SOURCE SCHEMATIC

The primary functions of the preamplifiers are to amplify the video output of the detectors to a usable level, establish a signal-to-noise ratio and provide an optimum impedance match between the high output impedance of the detectors and the lower impedance of the succeeding video stages. A gain control, R16, is also incorporated within the preamplifiers and its setting determines the output signal amplitude.

The output of 2A7 preamplifier is connected directly to the video selection switch 2A9 as originally. The output of the InSb preamplifier 2A8 has been removed from the video selection switch 2A9 and is now connected to a new InSb inverter circuit. The InSb detector responds to hot targets in an opposite manner to that of the GeIG detector and to correct for this polarity difference, a signal inverter has been added between the preamplifier 2A8 output and the post amplifier input. Refer to Figure 4-4 for a schematic of the inverter. The circuitry is the equivalent of the circuitry of the video selection switch module 2A9 with the exception of the electronic switch itself. An additional circuit to generate the required negative bias is also contained in this module. A negative 105 volts DC potential is applied to pin D of receptacle 2J4 and across a voltage divider circuit, resistors R11 and R10. The circuit is decoupled by capacitor C6 and the detector current is limited by resistor R12. An additional wire was added to the cable and connected to pin D of connector 2P4 to supply the -105 volts DC to the inverter module. The receptacle on the inverter module is identical to the input receptacle of the preamplifier 2A8. This allows removing the inverter from the system circuitry by

removing connector 2P4 from the inverter and connecting directly to the preamplifier 2A8 for original system operation if ever desired in the future.

The output of the video selector switch is still connected to the original post-amplifier 2A3. The output signal of the InSb inverter is routed through the original preamplifier 2A8 wiring, to connector 2P15 and receptacle 2J15. At receptacle 2J15 the original wiring to the video selector switch was removed and new wiring added to the input of the added post amplifier 2A3A. A coupling capacitor, 2C8A, was added to isolate the post-amplifier and the preamplifier if ever connected directly.

The support parameters for post amplifier 2A3A were obtained chiefly from a parallel connection to the original post amplifier 2A3. Refer to Figure 4-5, Sheet 2 of 2, for an inter-wiring schematic of the two post amplifiers. The connections were made at the decoupling capacitors, external to the postamplifier 2A3 enclosure. The off-time gate signal was obtained at receptacle 2J20 and connected through resistor 2R1A to duplicate the operation of post amplifier 2A3.

The post amplifier 2A8 output is connected to receptacle 2J11A located on the additional post amplifier enclosure. Figure 4-5, sheets 1 and 2, presents the wiring drawings of dual spectrum receiver as affected by the modification. Any further receiver wiring information can be obtained from the Air Force Technical Order 12P3-2AAS18-42, Section 7.

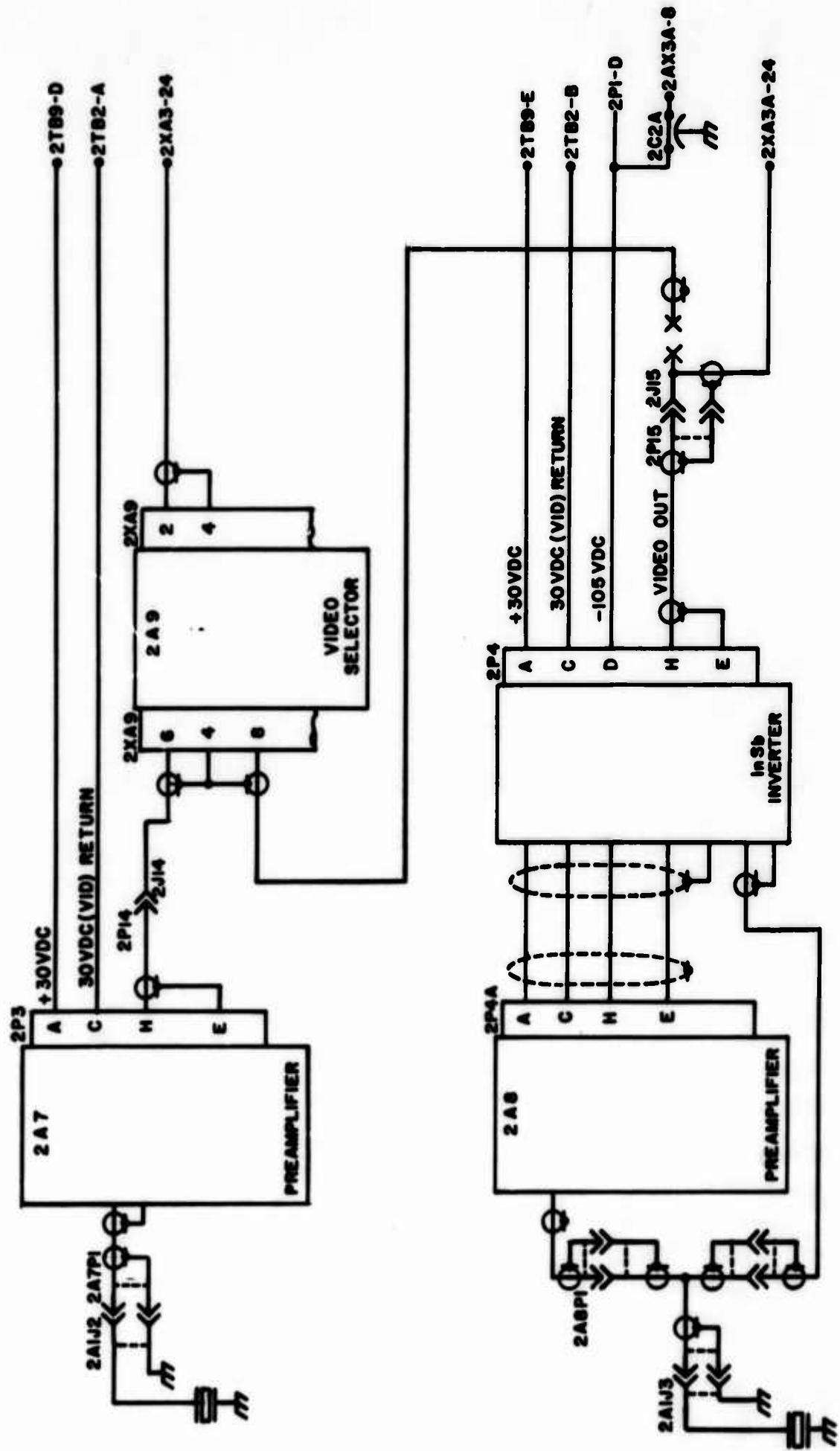


FIGURE 4-5. WIRING DIAGRAM OF RECEIVER MODIFICATIONS
SHEET 1 OF 2

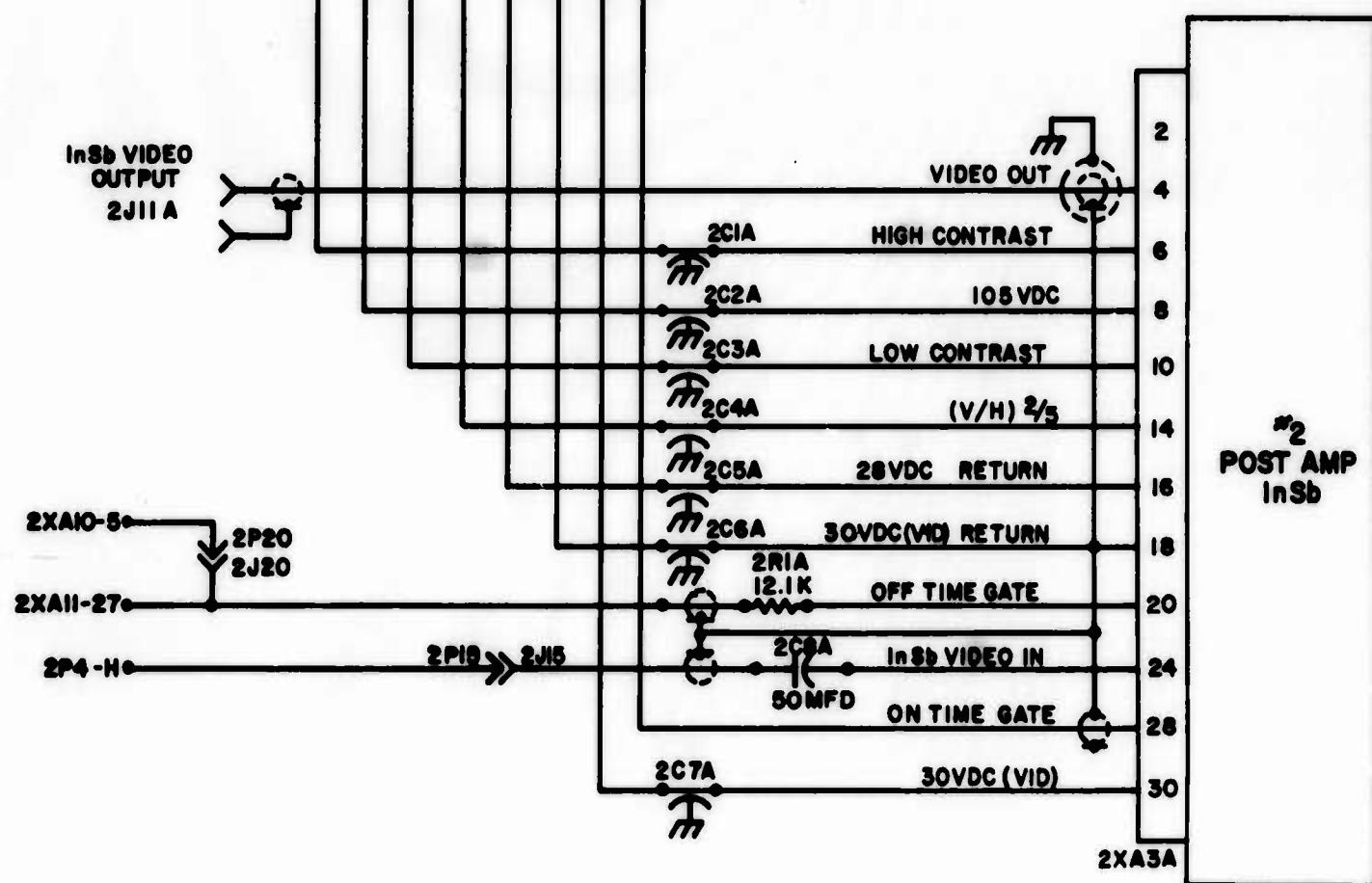
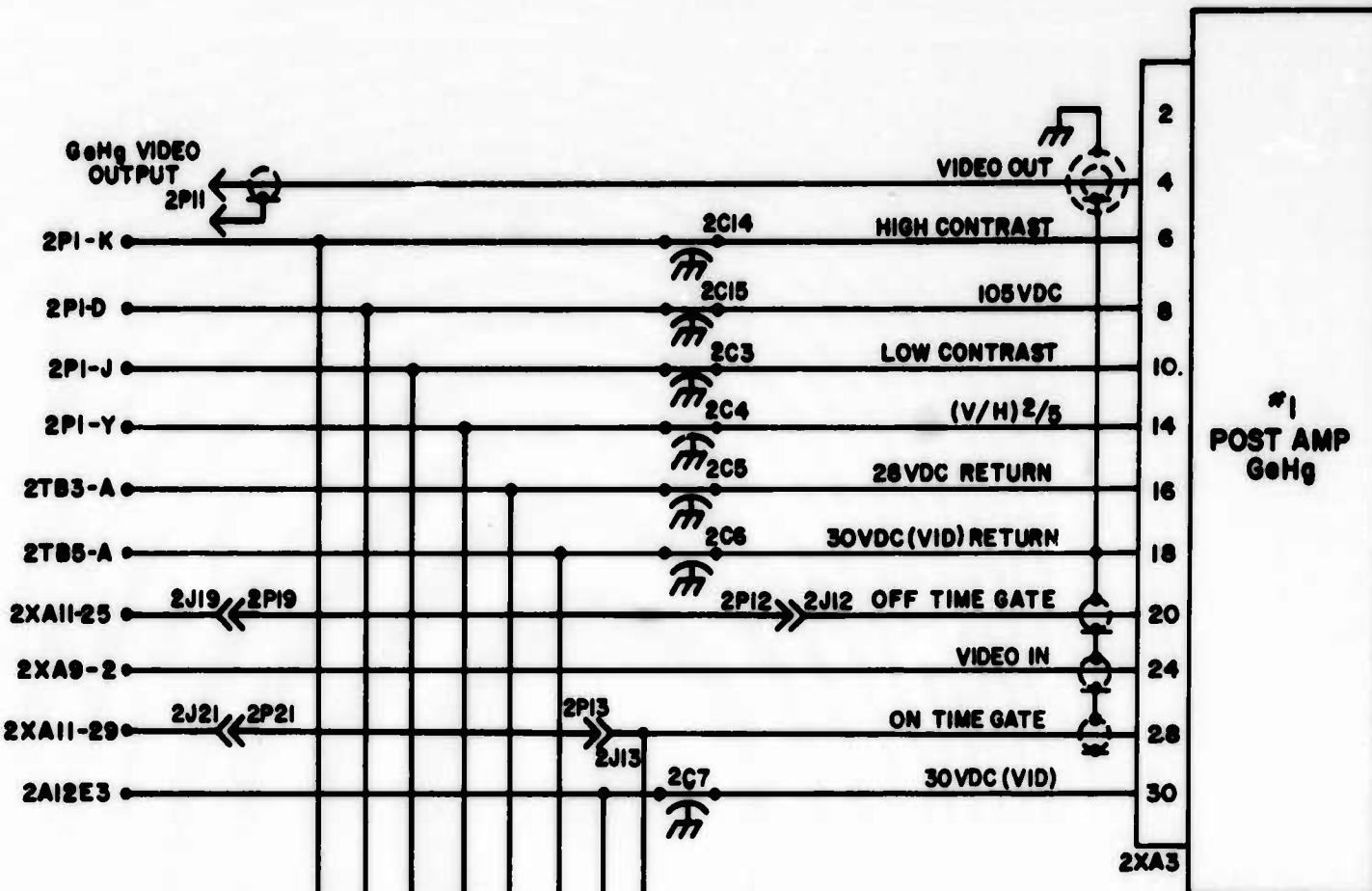


FIGURE 4-5. WIRING DIAGRAM OF RECEIVER MODIFICATIONS
SHEET 2 OF 2

SECTION V

DUAL INTERFACE BOX

General

The dual interface box was designed and fabricated to allow operation of both recorders and power supplies from the existing AN/AAS-18 control panel. This unit serves as a junction box in which commands and signals from the control panel, the gyro assembly and the AN/APN-153 Doppler Radar system are controlled and routed to the respective recorders when needed. Likewise, monitoring signals from both recorders can be selected for display on the AAS-18 control panel indicators thereby relating to the system operator the status of each recorder system while operating.

To operate the second recorder without its receiver, a receiver simulator was fabricated and located in the dual interface box. Also a regulator circuit is contained therein to linearize the system's V/H control and to supply power to the video summation amplifier located in the auxiliary control panel. This panel is presented in Section VI. Figure 5-1 presents a block diagram of the dual interface box and its position in the dual spectrum system.

System Control

The requirement existed for a single and a dual system operation capability. This was to be accomplished utilizing the existing AAS-18 control panel. Command signals from the control panel are routed through the dual interface box directly to recorder system #1 and through relay 5K1 to recorder system #2.

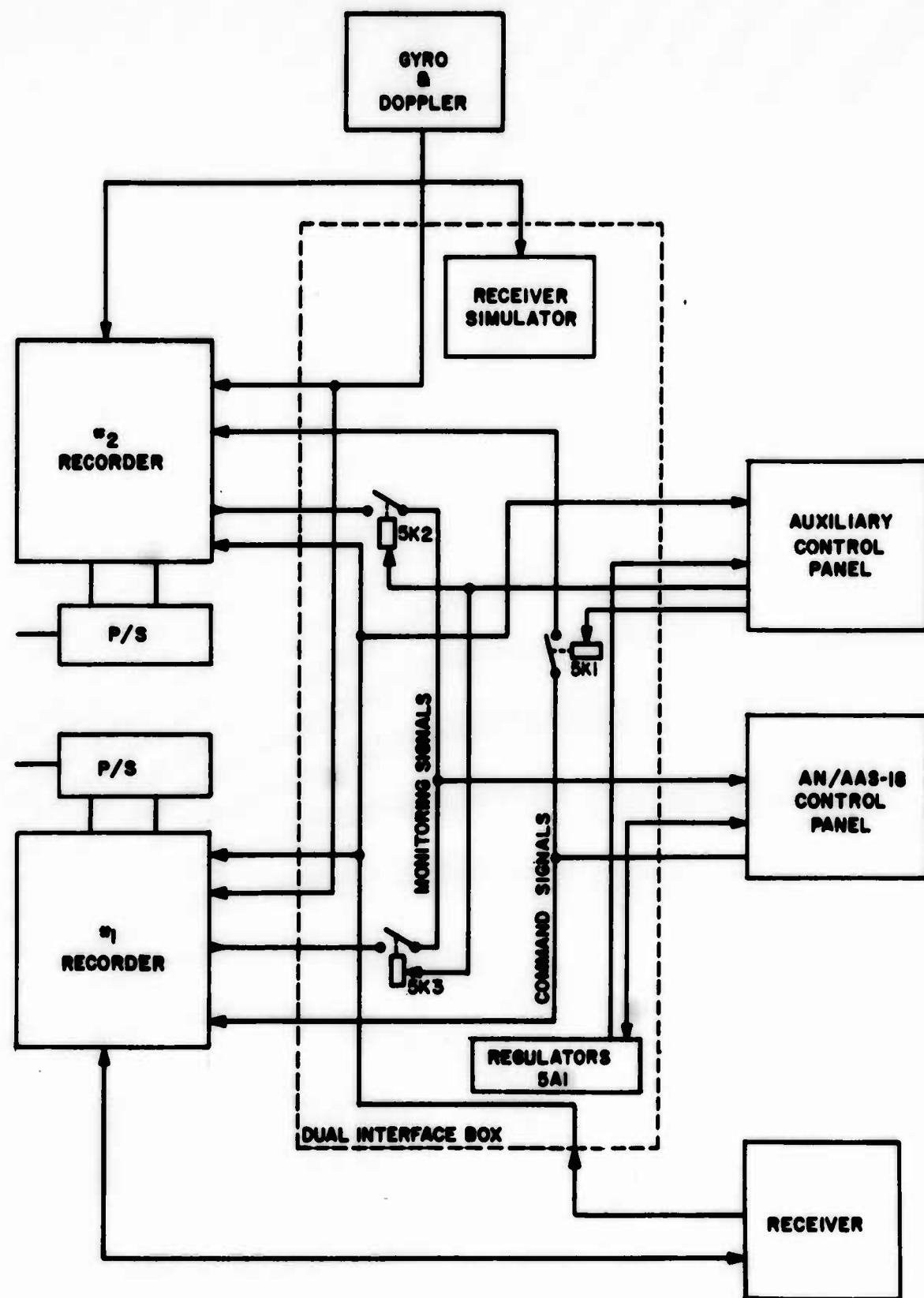


FIGURE 5-1. BLOCK DIAGRAM OF THE DUAL INTERFACE BOX

Recorder system #1 is the primary system and controls the operation of the systems receiver. Recorder system #2 is activated by placing a selector switch located on the auxiliary control panel to the dual position. This energizes relay 5K1 in the dual interface box and allows the command signals from the AAS-18 control panel to be applied to the #2 recorder system. There are six command signals that are controlled for dual system operation. These are the COOLER, READY, SCAN DRIVE, FILM DRIVE, VIDEO TEST and SELF TEST commands.

System Monitoring

The monitoring signals from both recorder systems are routed through relays located in the dual interface box prior to being connected to the display indicators on the AAS-18 control panel. With the use of a system monitor selector located on the auxiliary control panel, either system can be isolated from the indicators, leaving the remaining system to be monitored.

Recorder #1 monitor signals are routed through relay 5K3 and recorder #2's are routed through relay 5K2. Both relays are wired in common to the display indicators. Normal dual system operation is obtained by leaving both relays de-energized, allowing monitor signals from both systems to be connected to the indicators. When a malfunction does occur, isolation of the faulty system may be determined by selection of System #1 or System #2 on the monitor selector switch located on the auxiliary control panel. The system selected where the indicator stays illuminated is the faulty system.

Triaxial Receptacles Wiring

Signals from the receiver (sweep, gate, GeHg video and InSb video) are distributed to the respective recorders, the auxiliary control panel, and to test or monitor receptacles via RF wiring located within the dual interface box. Refer to Figure 5-2 for a diagram of the RF wiring of the Triaxial Receptacles located on the dual interface box.

Receiver Simulator

The receiver simulator includes a series of resistors used to duplicate the various loads the receiver would normally offer the recorder and power supply. A schematic of the simulator circuitry is presented in Figure 5-3.

V/H Linearization Circuit

The system V/H command signal originally was generated by connecting 100 volts DC across the V/H control on the AN/AAS-18 control panel. This control, a 5000 ohm potentiometer, coupled to a dialed knob, generated a voltage equivalent to required V/H by setting the dial to a given position as determined by an accompanying chart. The remaining voltage was routed directly into the recorder's input of approximately 70K ohms resulting in some non-linearity.

To eliminate this non-linearity and the chart, a new circuitry was incorporated and is located in the dual interface box. The 100 volts DC is now routed to the voltage regulator card 5A1 where it is dropped to approximately 35 volts DC at the emitter of Q1 and applied to potentiometer R3. (Refer to Figure 5-4 for a schematic of this circuit). Potentiometer R3 is adjusted to deliver 31.4 volts DC which is the voltage equi-

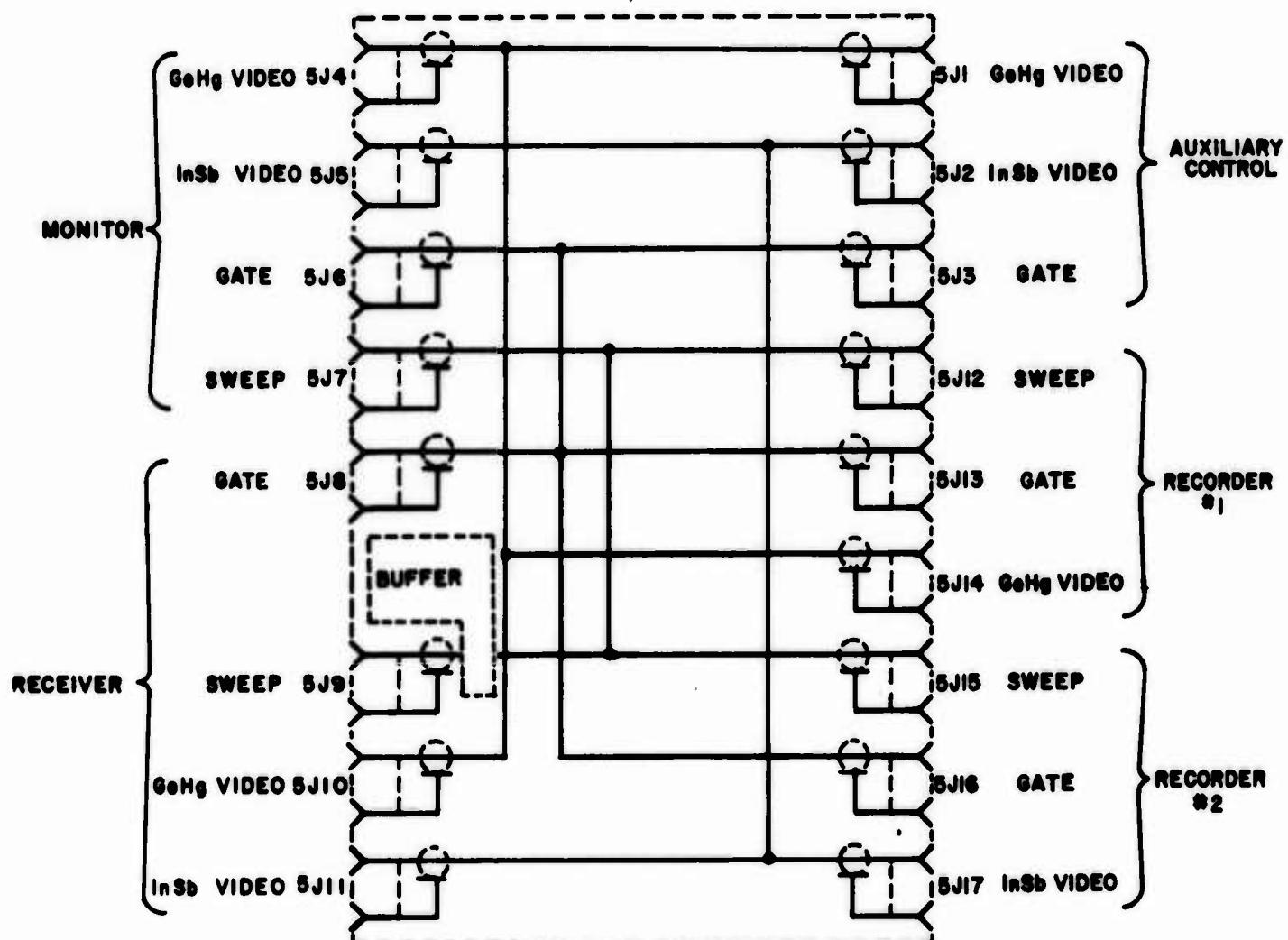
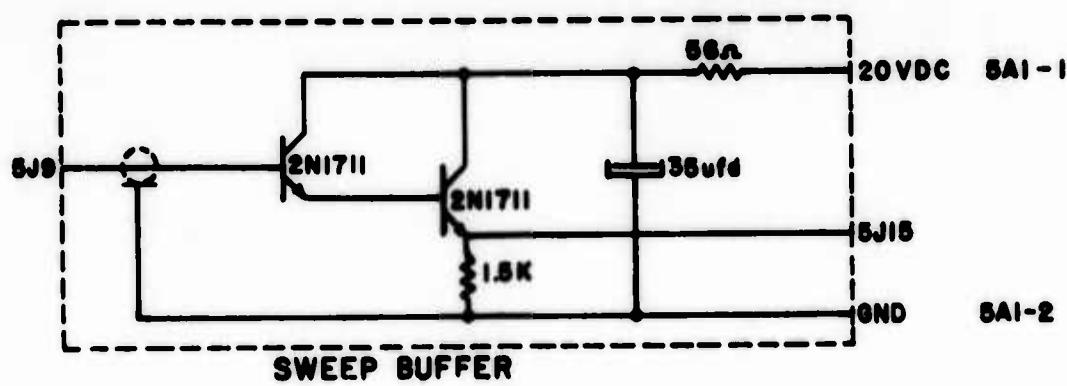


FIGURE 5-2 DUAL INTERFACE BOX TRIAXIAL RECEPTACLE WIRING

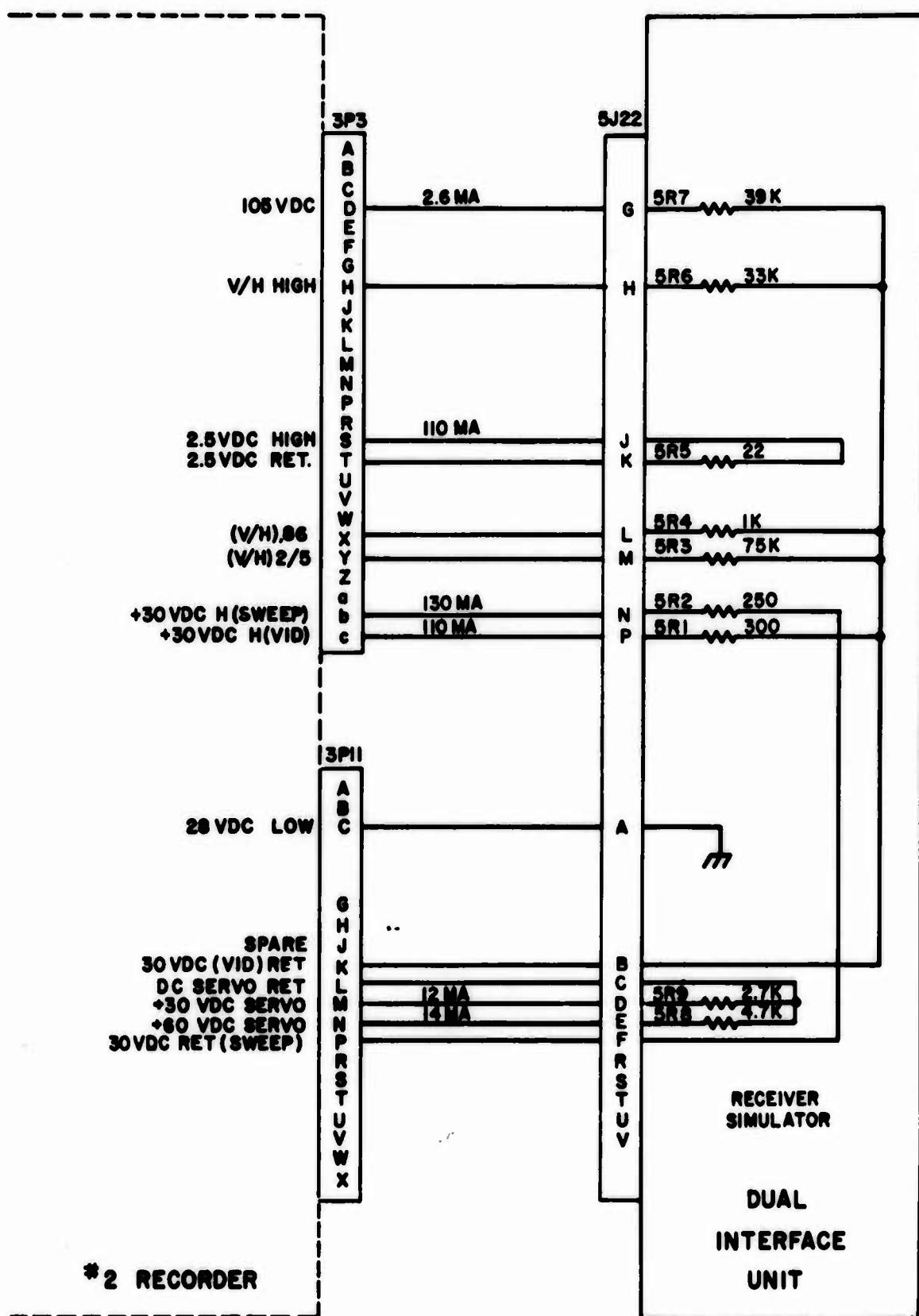


FIGURE 5-3. RECEIVER SIMULATION CIRCUITRY

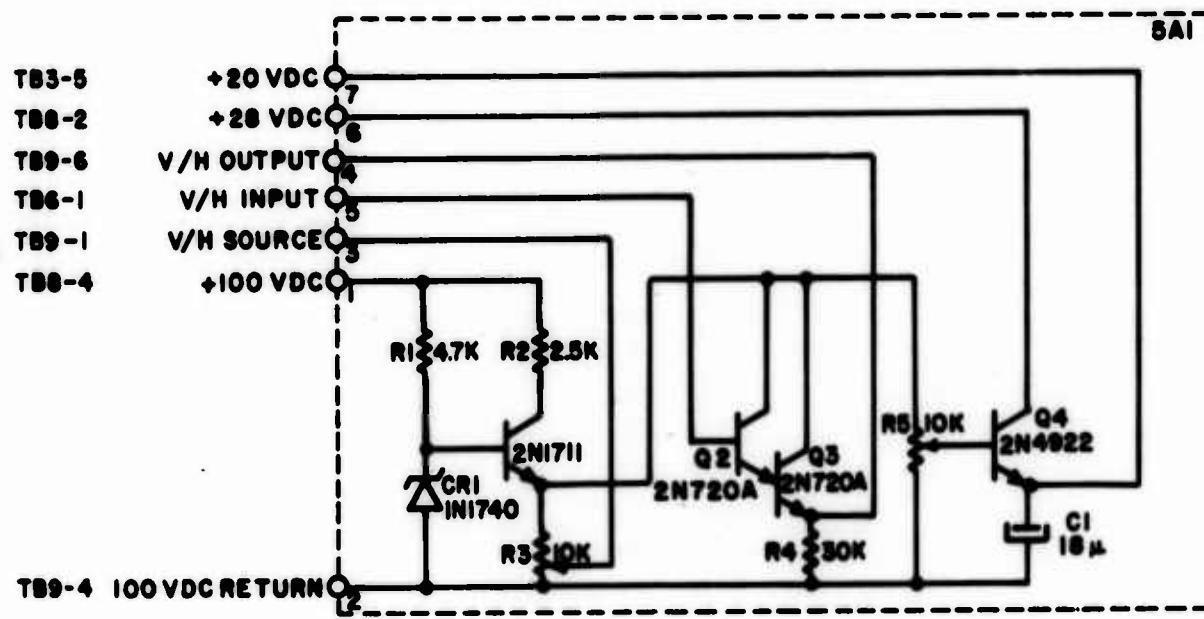


FIGURE 5-4. 5AI REGULATOR CARD SCHEMATIC

valent of a V/H of 1 radian per second plus the base to emitter junction voltage drop across transistors Q2 and Q3. This pickoff voltage is applied to the V/H control potentiometer on the AN/AAS-18 control panel. A voltage value equal to the percentage of a V/H value set on the control's dial is picked off and connected to the Darlington configuration of transistors Q2 and Q3. The output V/H signal to both recorders is obtained from the emitter of Q3. The result is a direct dial insert of any V/H value up to 1 radian per second. This eliminates the need for a special reference chart to correct for dial non-linearity that existed in the original system.

Summation Amplifier Power Regulator

Located on the circuit assembly, 5A1, is a second regulator used to obtain DC power for the summation amplifier located in the auxiliary control box. Referenced to the V/H regulator and adjusted by potentiometer R5, +20 volts DC is obtained and controlled for the summation amplifier requirements.

Gyro and Doppler Parameters

Pitch and roll signals from the system gyro assembly and drift signals from the AN/APN-153 Doppler Radar system are routed directly to both recorders with no alteration. The signals enter the dual interface box through receptacle 5J18 and are connected to terminal strips and to receptacles 5J19 and 5J20. Refer to Figure 5-5 for a complete wiring schematic of the dual interface box, and Table 5-1 for a reference of the terminal strip wiring.

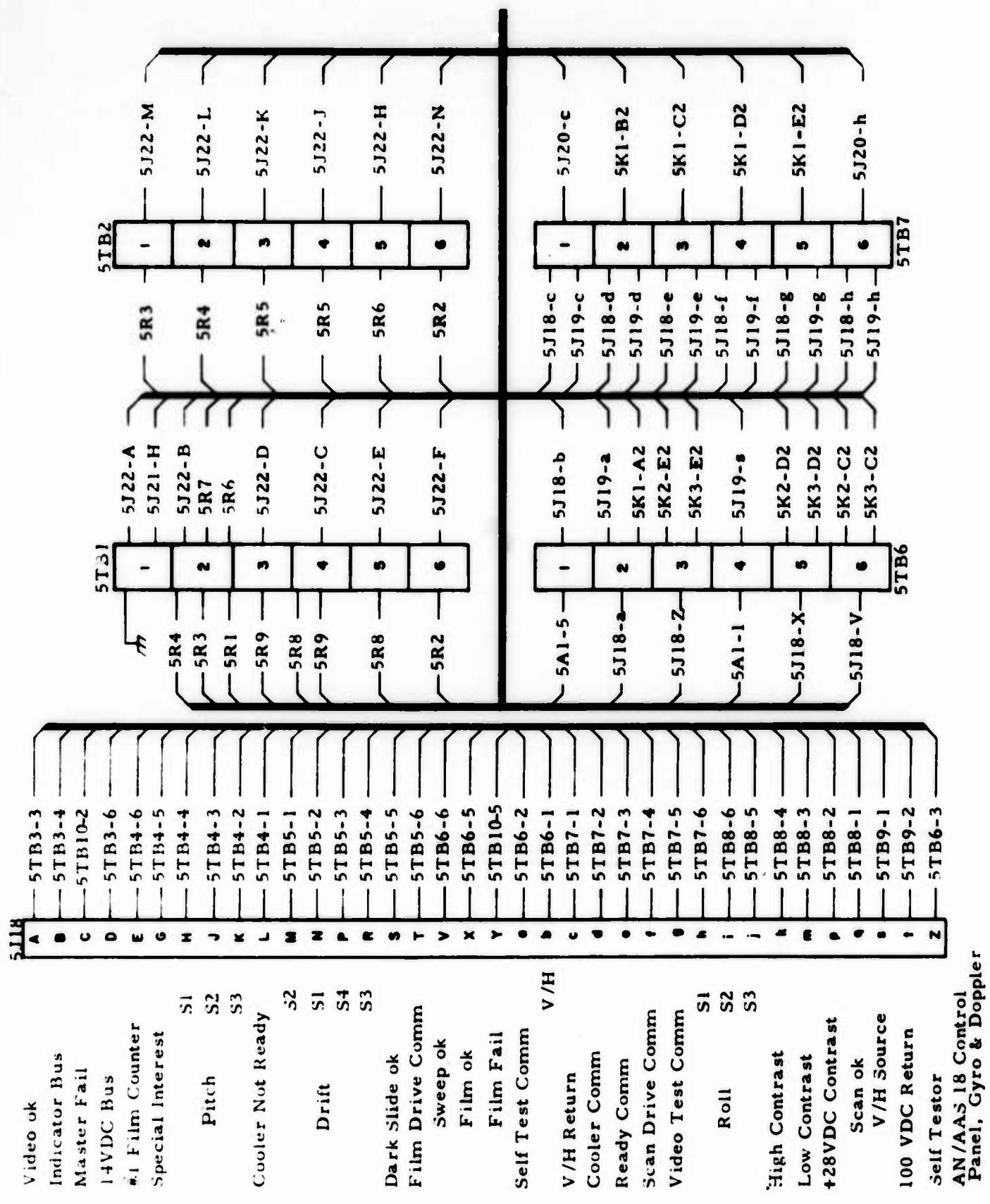


Figure 5 - 5. Dual Interface Box Wiring Diagram
Sheet 1 of 4

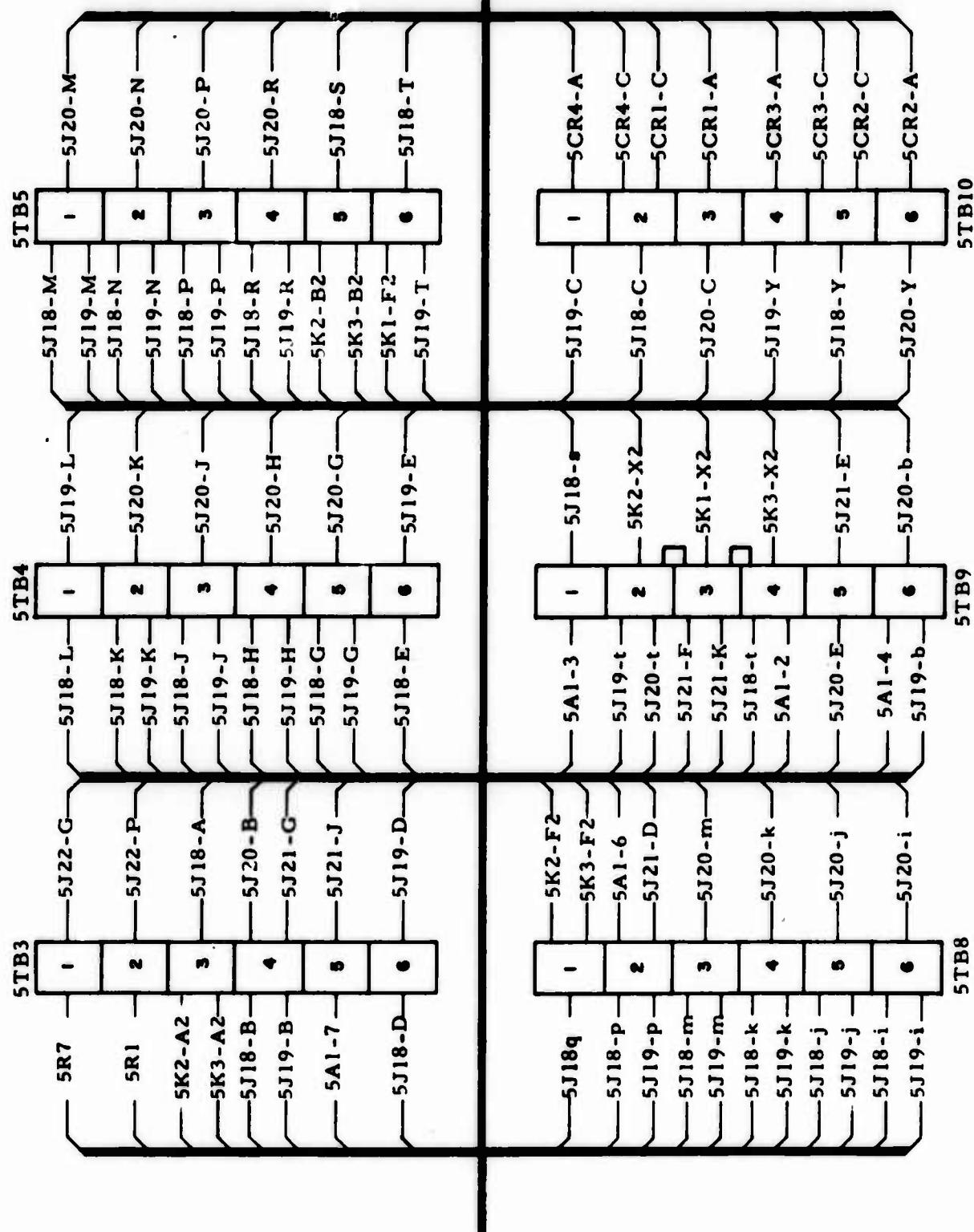


Figure 5 - 5. Dual Interface Box Wiring Diagram
Sheet 2 of 4

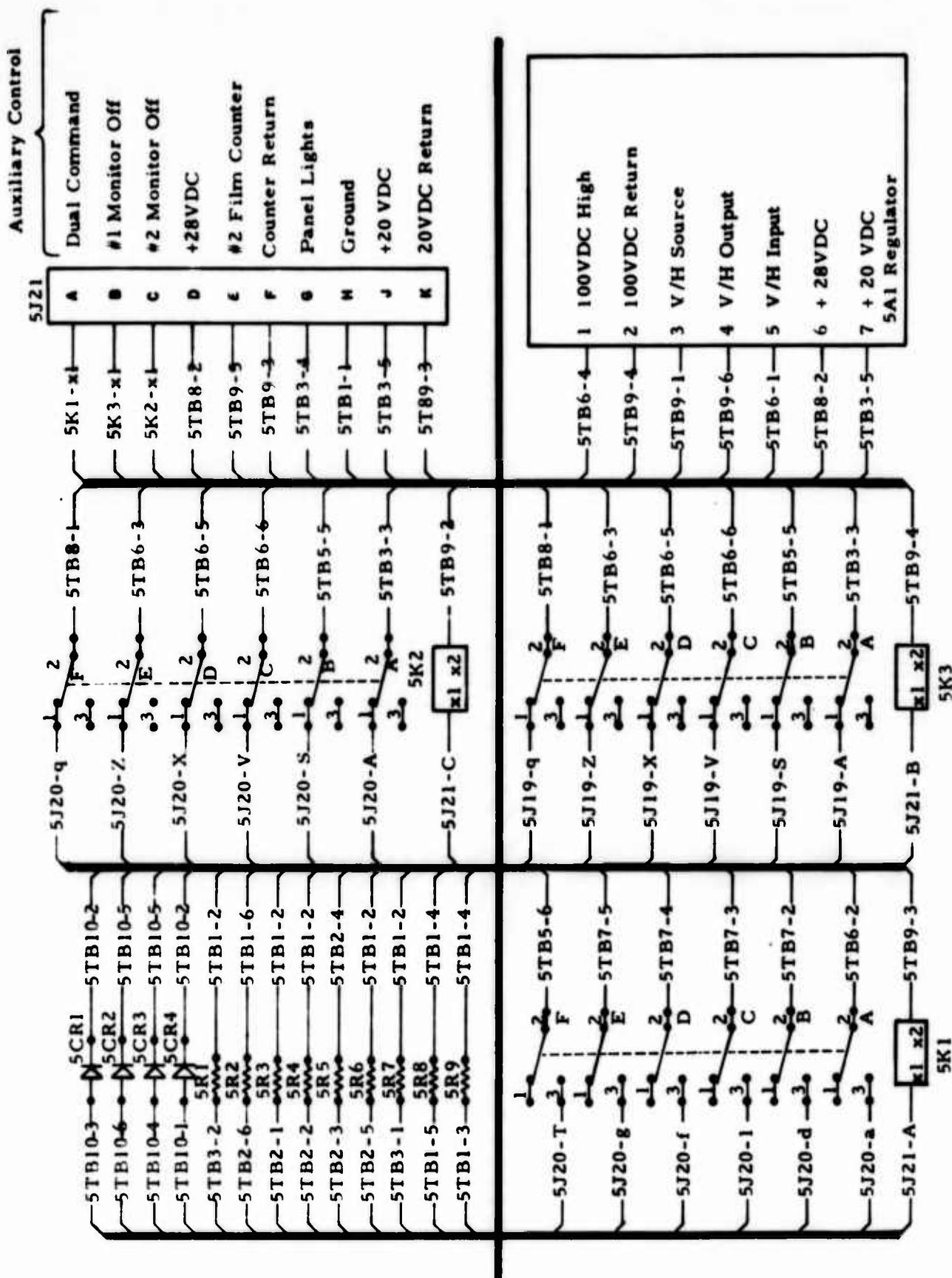
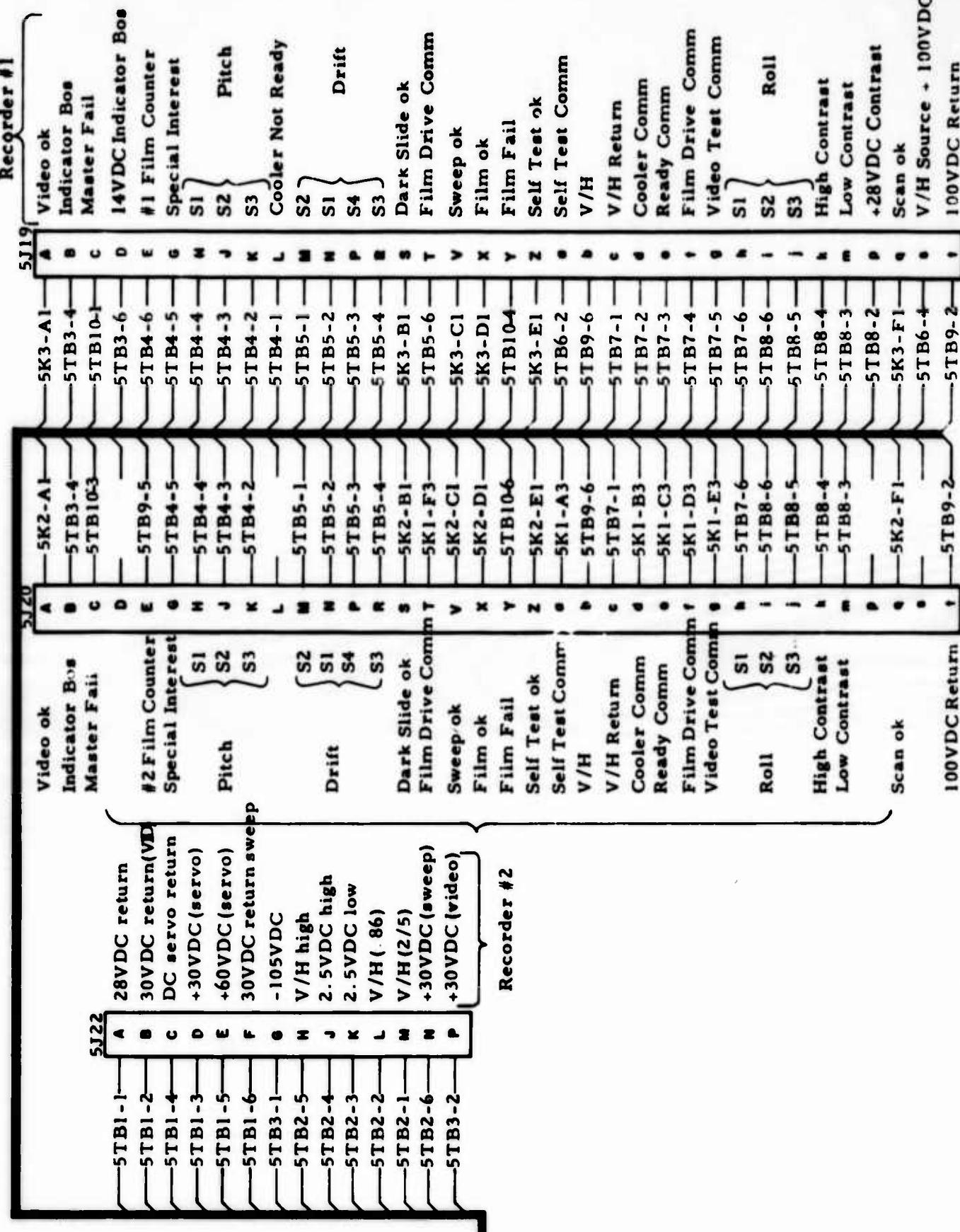


Figure 5 - 5. Dual Interface Box Wiring Diagram
Sheet 3 of 4



**Figure 5 - 5. Dual Interface Box Wiring Diagram
Sheet 4 of 4**

Film and Master Fail Monitor

The film and master fail monitoring circuits from both recorders are connected through steering diodes to the respective indicators located on the AN/AAS-18 control box. These are direct circuits and the position of the selector switches of the auxiliary control panel have no direct effect. When a malfunction occurs in either system, the master fail and/or the film fail indicator will come on. By selection of system #1 or system #2 on the system monitor selector located on the auxilary control panel and exercising the system self-test capability on the control panel, it is possible to determine what the fault is and which system it is in.

TB-10	TB-9	TB-8	TB-7	TB-6	TB-5	TB-4	TB-3	TB-2	TB-1	
5A1-4 J20b 5CR2-A	J18i J19i J20i	J18h J19h J20h	K2C2 K3C2 J18V	K1F2 J18T J19T	J18E J19E	J18D J19D	J22N 5R2	J22F 5R2	6	
J18Y 5CR2-C 5CR3-C	J18j J19j J20j	K1E2 J18g J19g	K2D2 K3D2 J18X	K2B2 K3B2 J18S	J18G J19G J20G	J21J 5A1-7	J22H 5RG	J22E 5R8	5	
J19Y 5CR3-A	5A1-2 J18t	J18k J19k	K1D2 J18f	J18R J19s	J18H J19R	J18B J19B	J22J	5R8 J22C	4	
J20C 5CR1-A	K3 x2	J20k	J19f	5A1-1	J20R	J20H	J20B J21G	5R5	5R9	
J21F J21K 5CR1-A	J18m J19m J20m	K1C2 J18e J19e	K2E2 K3E2 J18z	J18P J19P J20P	J18J J19J J20J	K2A2 K3A2 J18A	J22K 5R5	J22D 5R9	3	
J18C 5CR1-C 5CR4-C	K2 x2	J21D 5A1-6 J19p	K1B2	K1A2	J18N	J18K				
J19C 5CR4-A	J20t J19t	J18p J19d	J18d J19a	J18a J19a	J19N	J19K	J22P	J22L 5R45R1 5R3	J22B 5R3	2
					J20N	J20K	5R1	5R4		
					J18M J19M J20M	J18L J19L	J22G 5R7	J22M 5R3	J22A J21H	1

Table 5 - 1. Terminal Strip Wiring

SECTION VI

AUXILIARY CONTROL PANEL

General

The auxiliary control panel contains the needed additional controls, a second film remaining counter, and a video summation amplifier needed to fulfill the requirements of the dual spectrum system. Designed to be incorporated into a standard aircraft control console, the panel is backlighted for operation in reduced ambient light conditions.

Control Selector

Located in the upper left corner of the auxiliary control panel is the control selector switch. Refer to Figure 6-1 for a view of the panel. A single throw switch that may be positioned in either the single or dual position, this switch controls the status of the system #2 control relay 5K1 located in the dual interface box. When this switch is positioned into the DUAL position, relay 5K1 is energized allowing the system command signals to be routed to the #2 recorder system for dual system operation. In the single position, the relay remains in the de-energized position.

Monitor Selector

Positioned in the upper right corner of the panel, this double throw switch may be positioned in one of three positions. It is used for determining which system or both is to be monitored by the indicators on the AN/AAS-18 control panel. When positioned in the System #1 position, power is applied to relay

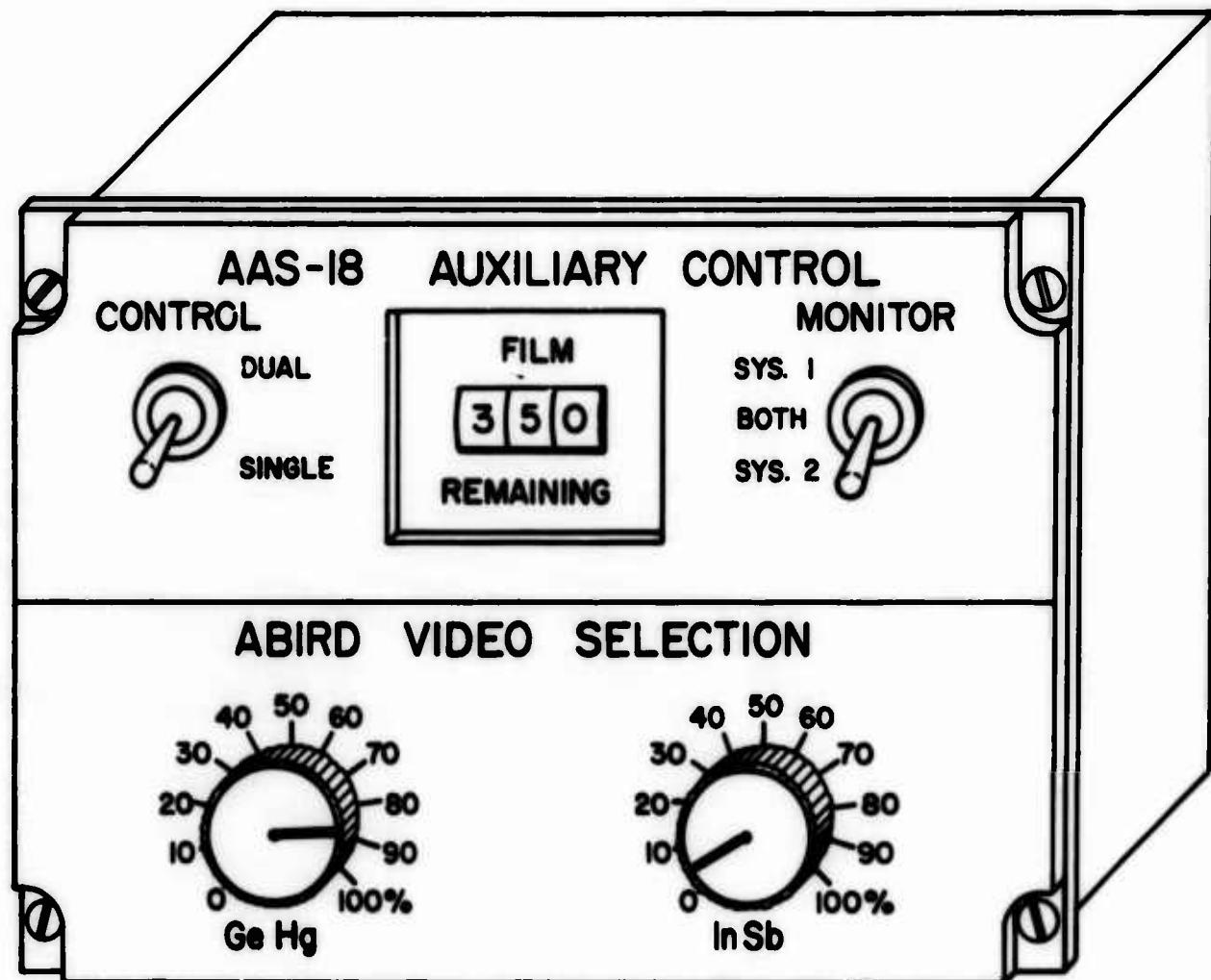


FIGURE 6-1. AUXILIARY CONTROL PANEL

SK2 in the dual interface box, energizing it and opening the monitor lines from recorder #2. This leaves only recorder #1 to be monitored. When this switch is placed in the System #2 position, relay SK3 in the dual interface box is energized, opening the monitor lines from recorder #1, and allowing only recorder #2 to be monitored on the indicators. Positioning this switch in the BOTH position permits both relays, SK2 and SK3, to remain de-energized, allowing both recorder's monitoring signals to be applied to the indicators.

Film Counter

Located top center on the auxiliary control panel is an electro-mechanical film remaining counter. This counter is a decreasing step counter monitoring the film remaining in the #2 recorder system.

ABIRD Video Selection Controls

The mercury-doped germanium (GeHg) and the indium antimonide (InSb) controls on the lower half of the auxiliary control panel are used to select the percentage of the respective video input signals that will be summed together to generate the ABIRD (Airborne Infrared Raster Display) video signal. The two video signals, as selected by the position of the GeHg and InSb controls, are summed together by the summation amplifier 6A1, located in the bottom section of the auxiliary control panel. A schematic of this summation amplifier is presented in Figure 6-2. The resulting output signal, an algebraic sum of the two input signals, is available for use with the ABIRD system and for monitoring

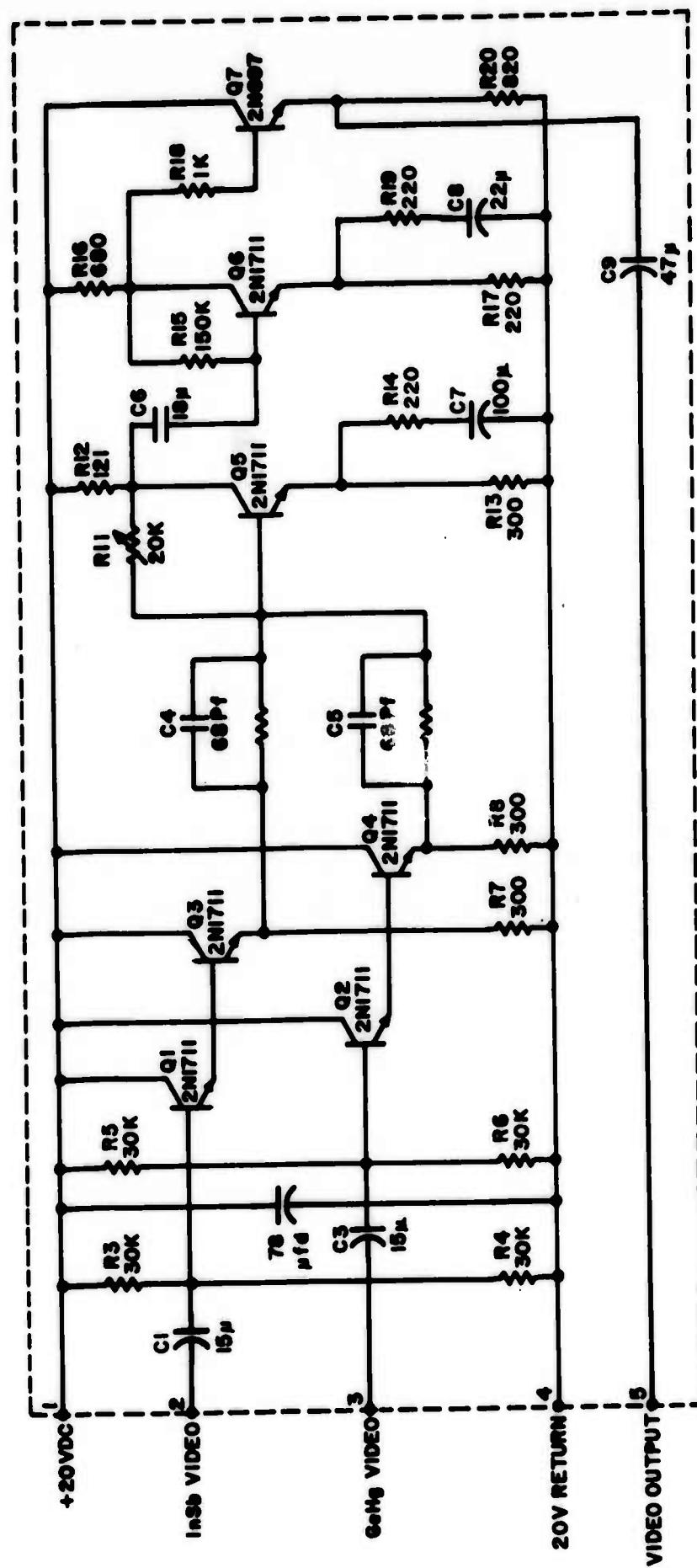


FIGURE 6-2. 6AI SUMMATION AMPLIFIER SCHEMATIC

with an oscilloscope or recording onto magnetic tape. Power for the amplifier is obtained from the dual interface box.

Shown in Figure 6-3 is a complete wiring diagram of the auxiliary control panel.

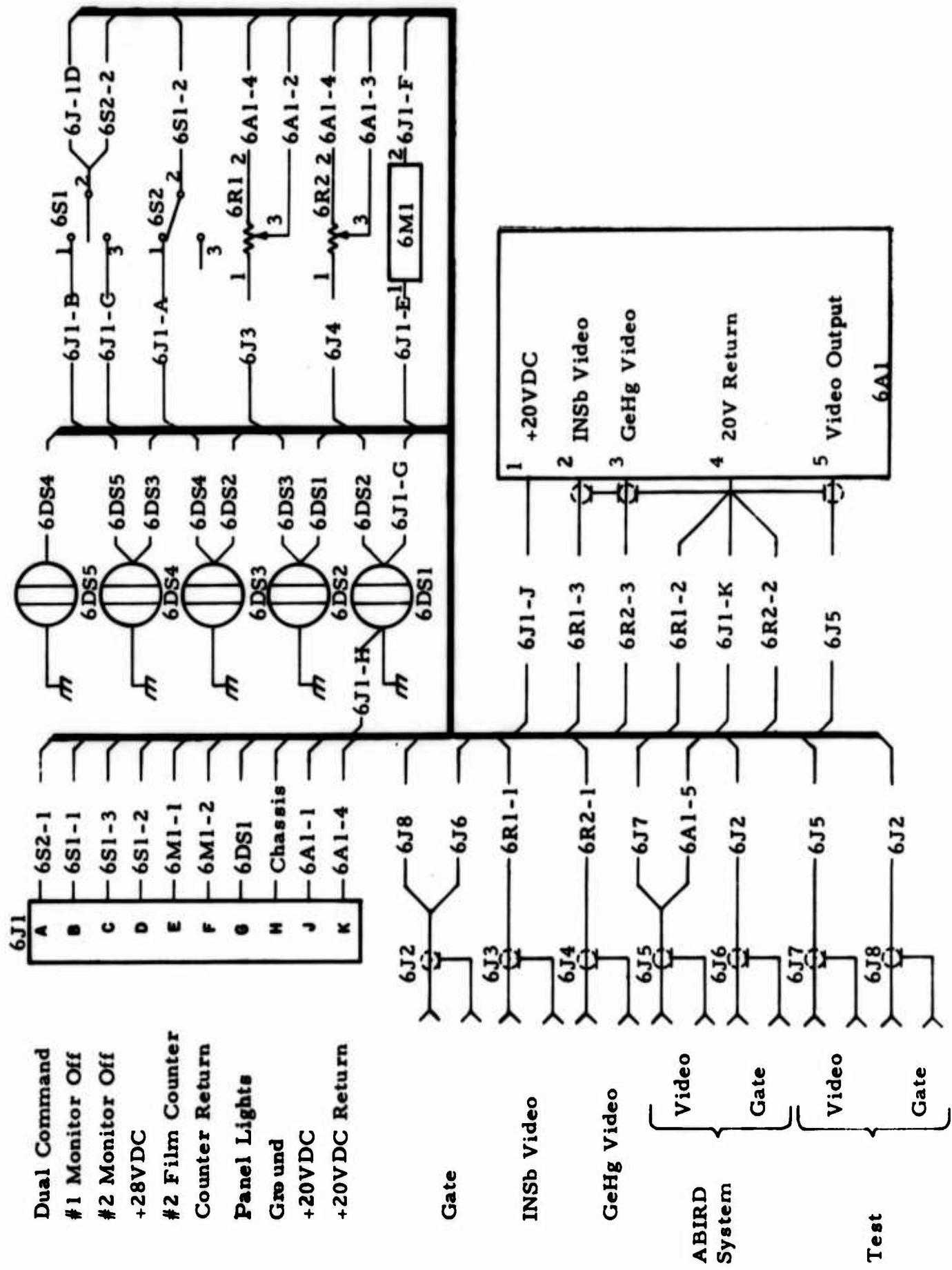


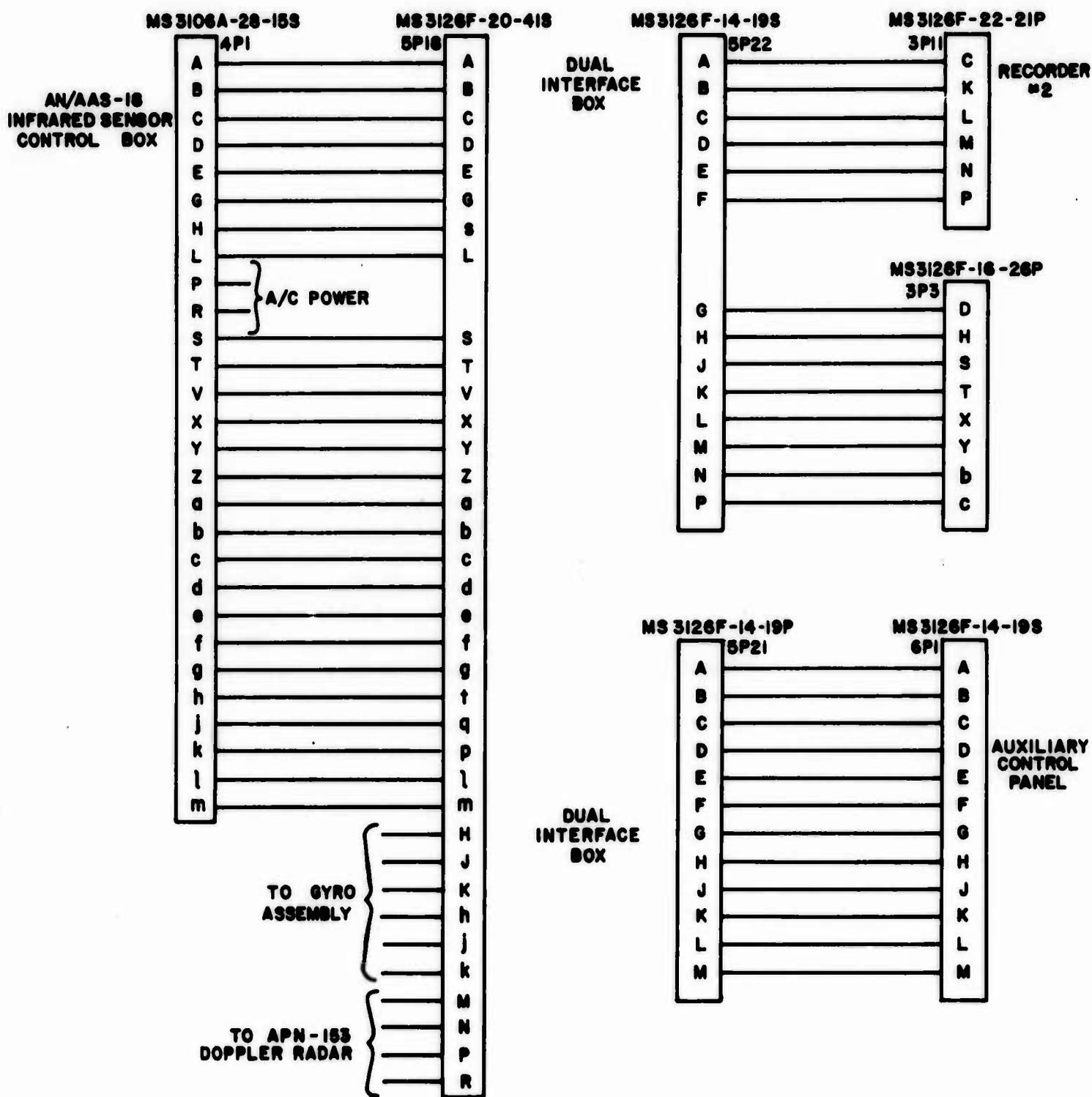
FIGURE 6-3 AUXILIARY CONTROL PANEL WIRING DIAGRAM

SECTION VII

SYSTEM CABLING SCHEMATICS

Cabling for the dual spectrum system, shown in Figure 3-1, consists of basically the original system wiring with the following exceptions: (1) the two new cables between the dual interface box receptacles 5J19 and 5J20 and recorders #1 and #2 receptacle 3J5 respectively, (2) a new cable between recorder #2 receptacles 3J3 and 3J11 and the dual interface box receptacle 5J22, (3) a new cable between receptacle 5J21 on the dual interface box and the auxiliary control panel receptacle 6J1.

The cable between the dual interface box 5J18 and the AN/AAS-18 control panel receptacle 4J1 and the gyro assembly is used as before. The remaining cables are the same as far as an original system installation. Refer to Technical Order 12P3-2AAS18-42 for a schematic of each of the respective cables. Wiring diagrams for the new cables of the dual spectrum system are shown in Figure 7-1, sheets 1 and 2.



**FIGURE 7-1. SHEET 1 OF 2
CABLE WIRING DIAGRAM**

RECORDER #1 3P5
MS3I26F-20-41S

RECORDER #2 3P5
MS3I26F-20-41S

SP19 DUAL INTERFACE BOX
MS3I26F-20-41P

SP20 DUAL INTERFACE BOX
MS3I26F-20-41PW

DAGE 2675-1
CONNECTOR

ALL TRIAXIAL
CABLES

AMPHENOL 21-738
TRIAXIAL CABLE

FIGURE 7-1 SHEET 2 OF 2
CABLE WIRING DIAGRAM

SECTION VIII

SYSTEM OPERATING PROCEDURES

The following procedures are to be used to operate the Dual Spectrum AN/AAS-18 Infrared Detection System. Procedures are contained for single system operation first and for dual system operation second.

NOTE

Prior to any system activation, check the system for proper servicing. This includes the scanner helium pressure and the amount of film in the two recorder magazines. After proper servicing, check that the dark slides have been pulled from the film magazines and that all system cabling is connected.

Single System Turn-On Procedures

On the AN/AAS-18 Control Panel:

1. Check the control switch is in the OFF position
2. Activate aircraft power, check for proper phase and voltages
3. Press in the circuit breakers for the AN/AAS-18 system
 - (a) Blower (2)
 - (b) Gyro (2)
 - (c) AN/AAS-18 #1 (3)
 - (d) AN/AAS-18 #2 (2)
 - (e) ABIRD (2)
4. At the control console, place blower switch to ON.

Note: Blower light comes on.

5. On the AN/AAS-18 control panel, place the function selector to COOL.

NOTE

Approximately 7 minutes are required for cool-down of the cooler-detector assembly.

6. Place the contrast control switch to desired position.
Usually in NORMAL.
7. Rotate the V/H control to the desired setting.
8. Check that the V/H toggle switch is in MANUAL.
9. Place the panel light switch to desired position.
10. Reset the film remaining counters to amount of film in magazines if a new roll has been installed.
(Recorder #1 on the control panel and Recorder #2 on the auxiliary control panel).
11. Activate the ABIRD system in accordance with the system manual, if required for the mission.
12. Check that the green OK light on the gyro assembly is on. (Located beside the Blower light on the control console.)
13. On the Auxiliary Control Panel, place the control switch to SINGLE.
14. Place the monitor switch to SYS-1.
15. Rotate the GeHg and InSb controls to 0%.
16. On the AN/AAS-18 Control Panel, place the function selector to READY.

NOTE

This position turns on the scanner and activates all the units of system #1. If only the ABIRD is going to be used and no film is to be recorded, leave the function selector in this position.

17. On the Auxiliary Control Panel, rotate the GeHg and InSb controls as desired for ABIRD operation.

NOTE

If a film record is to be made, proceed with the next step.

18. Place the function selector to RECORD.

NOTE

The Master Fail and the Film Fail lights are always on in READY mode regardless of system condition and remain on for approximately 7 seconds after selecting RECORD and then go out. If they fail to go out, perform a self check in accordance with the procedures outlined at the end of these operating procedures.

In this condition, recorder #1 is recording GeHg video information from the scanner. The operator should note the film remaining counter on the AN/AAS-18 control panel is operating. Also, both the GeHg and InSb video information is available for use with the ABIRD system and for inflight recording onto video magnetic tape.

19. Change the V/H setting as necessary.
20. Change the contrast switch as needed.

21. Adjust the InSb and GeHg controls on the Auxiliary control panel as desired for ABIRD operation.

NOTE

At any time the operator does not wish to record film, place the function selector to READY. This position still allows operation of the scanner for magnetic tape recording and for ABIRD operation.

Dual System Turn-On Procedures

1. Complete steps 1 through 12 of the single system turn procedures.
2. On the Auxiliary Control Panel, place the control switch to DUAL.
3. Place the monitor switch to BOTH.
4. Rotate the GeHg and InSb controls to 0%.
5. On the AN/AAS-18 Control Panel, place the function selector to READY.

NOTE

This position turns on the scanner and activates all the units of the Dual Spectrum System.

6. When ready to record film, place the function selector to RECORD.

NOTE

Both recorders should be operating. Check for film remaining counter operation of both recorders.

7. Rest V/H control as needed.

8. Change the contrast switch as desired.
9. If using the ABIRD System, readjust the GeHg and InSb controls on the Auxiliary Control Panel as required.
10. Monitor the film fail and the master fail lamps during system operation.

NOTE

If either or both lamps come on during system operation in RECORD, proceed with the system self check procedures outlined later in this section.

Turn-OFF Procedures. (Single and Dual Operations)

1. Place function selector to READY

NOTE

This position stops both recorders from exposing film but leaves all the selected systems operating. The scanner is still operating and the video information can be monitored on the ABIRD or other monitoring devices or systems.

NOTE

Make sure FILM FAIL light is on indicating stoppage of film movement before leaving READY position, to guard against possible film jamming.

2. Place the function selector to COOL.

NOTE

This position shuts down electrical power to all units except the cooler pump and Vacion High Voltage Power Supply on the receiver.

3. Place function selector to OFF.
4. Place the blower switch to OFF.
5. Pull the following circuit breakers.
 - (a) Blower
 - (b) Gyro
 - (c) AN/AAS-18 #1
 - (d) AN/AAS-18 #2
 - (e) ABIRD

NOTE

Insert dark slides before removing the film magazines from the recorders.

Self Check Procedures

The following procedures can be used to self check each recording system of the Dual Spectrum Detection System. These procedures apply to Single or Dual system operation.

1. Place the monitor switch on the Auxiliary Control Panel to SYS #1.
2. On the AN/AAS-18 Control Panel, position the function selector control to SELF TEST.
3. Press in and hold, the self test push button switch on the AN/AAS-18 Control Panel while rotating the function selector slowly through positions; SCAN, SWEEP, THRESHOLD, VIDEO, FILM and DARK SLIDE.

The green GO light should illuminate while in each position and the self test switch is held depressed.

NOTE

Wait up to 15 seconds in SELF TEST and FILM positions for the GO light to appear.

4. Use standard trouble shooting procedures as outlined in the Air Force Technical Order 12P3-2AAS-18-42 for locating a given malfunction as indicated by the GO light not illuminating during previous step 3.
5. Rotate the function selector control back to READY.

NOTE

Complete the following procedures for dual system operation.

6. On the Auxiliary Control Panel place the monitor switch to SYS #2.

NOTE

In SYS #2 position, the self test commands and monitoring are to and from recording system #2 only.

7. Repeat steps 1 through 5 above as for SYS #1.

SECTION IX

SUMMARY AND CONCLUSIONS

SUMMARY

The modification of the system was a straight forward program. No problem areas were encountered which required excessive engineering to satisfy. Likewise, no extraordinary design effort was required to obtain the contractual objectives. Bench tests indicated proper operation in both single and dual modes. The new dual system passed the electromagnetic interference tests and the explosion tests successfully. Flight tests of the dual system are presently underway.

Conclusion

As a result of the satisfactory completion of the modification program, the new dual spectrum infrared detection system has been provided with the capability of obtaining dual, simultaneous, IR film records of any given target, in two given spectral regions under identical conditions as regards environmental and equipment conditions.

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13. ABSTRACT A system to obtain dual synchronous film records of a target in two different spectrums of the infrared region was required. An AN/AAS-18 Infrared Detecting Set Receiver was modified to contain two different detectors, one of Indium Antimonide, InSb, the other of Mercury-Doped Germanium, GeHg, plus additional circuitry to provide a video output from each detector. Two AN/AAS-18 Recorders and Power Supplies were interfaced together and operated from a common Control Panel to record on film the video information. An amplifier and controls were added to select an infinite value of either or both detector's video to be used with the Air Borne Infrared Raster Display system (ABIRD). As modified, the Dual Spectrum Detection System allows film records of a target to be obtained in the 3 to 5 micron and the 8 to 13 micron regions. The two channels may also be monitored simultaneously on a real-time display of the ABIRD system.		

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14 KEY WORDS	LINK A		LINK B		LINK C	
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7400 COLONEL GLENN HIGHWAY • DAYTON, OHIO 45431

PHONE 813/428-2408 TWX: 810-480-2620

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MEMORANDUM TO: All recipients of Technology Incorporated's Technical Report AFAL-TR-70-184, titled AN/AAS-18 IR Set Modification to Dual Spectrum Capability, dated September 1970, authored by A. Meyer under the provisions of Contract No. F33615-69-C-1902.

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